Species Diversity, 2002, 7, 251–312

Systematics and Distribution of Fishes of the Asian Goby Genera *Chaenogobius* and *Gymnogobius* (Osteichthyes: Perciformes: Gobiidae), with the Description of a New Species

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(Received 3 April 2001; Accepted 10 May 2002)

The Asian goby genera *Chaenogobius* Gill and *Gymnogobius* Gill, the two Western North Pacific representatives of the *Chasmichthys* Group, are revised. A key is provided for each genus. *Chaenogobius* includes two species found in shallow marine waters along the coasts of Japan and the Korean Peninsula. *Gymnogobius* includes thirteen species found in shallow marine, brackish, and fresh waters throughout Japan, the Russian Far East, the Kuril Islands, the Korean Peninsula, and the Yellow Sea. A new species, *Gymnogobius opperiens*, is described from Japan, the Russian Far East, and the Kuril Islands, and a species previously thought to be undescribed is recognized as *Gymnogobius petschiliensis* (Rendahl, 1924).

Key Words: Gobiidae, Asia, *Chaenogobius*, *Gymnogobius*, *Chasmichthys*

Introduction

The gobioid fauna of eastern Asia and the Western North Pacific includes approximately 62 genera, most of which are also found in the Indo-West Pacific (Birdsong *et al.* 1988). The *Chasmichthys* Group of Birdsong *et al.* (1988) is diagnosed by the insertion of the anteriormost pterygiophore of the first dorsal fin in the fourth or fifth interneural space, as opposed to the third interneural space, which is the typical gobioid condition. It includes a total of eight genera. Two of these genera are found only in the Western North Pacific, and the other six are found exclusively in the Eastern North Pacific along the coast of North America. Until recently, material of the two Western North Pacific genera was misidentified as *Chasmichthys*, containing two species, and *Chaenogobius*, containing 12 to 14 species (Akihito *et al.* 1984; Pinchuk 1984); however, Stevenson (2000), based on examination of the recently rediscovered holotype of *Chaenogobius annularis* Gill, 1859, the type species of *Chaenogobius*, concluded that *C. annularis* is a senior synonym of *Gobius dolichognathus* Hilgendorf, 1879, the type species of *Chasmichthys*. As he pointed out, this discovery forces recognition of *Chaenogobius* as a senior synonym of *Chasmichthys* and dictates the referral of the other species formerly included in *Chaenogobius* to the next oldest available genus, *Gymnogobius* Gill, 1863.

The taxonomic history of *Gymnogobius* (formerly recognized as *Chaenogobius*)

is complex. Gill (1863) erected *Gymnogobius* in a single sentence, in which he also erected three other genera. He established *Gobius macrognathos* Bleeker, 1860, described as scaleless, as the type species. Jordan and Snyder (1901a) suggested that *Gymnogobius* might be synonymous with *Chaenogobius* but stated that they could not be sure because they had not examined the type species of either genus. Koumans (1931) later determined that the holotype of *G. macrognathos* was not scaleless, but had only lost its scales in preservation. This erased the major difference thought to exist between *Gymnogobius* and *Chaenogobius*, and American and Japanese authors (e.g., Jordan *et al.* 1913; Jordan 1919; Tomiyama 1936; Fowler 1961) throughout the 20th century accepted Jordan and Snyder's (1901a) suggestion, recognizing *Gymnogobius* as a junior synonym of *Chaenogobius*. In contrast, Russian authors (Shmidt 1904, 1950; Berg 1916, 1949; Taranetz 1933, 1934; Nikolsky 1956; Lindberg and Krasyukova 1975) were reluctant to recognize *Chaenogobius*. They continued to recognize *Gymnogobius* (although the species they identified as *Gymnogobius macrognathos* was in most cases *Gobius urotaenia* Hilgendorf, 1879) until Pinchuk (1978) synonymized it with *Chaenogobius*, reconciling the two positions.

The taxonomic history of *Chaenogobius* (=*Chasmichthys*) is equally complex (Stevenson 2000). Gill's (1859) description of the genus and its type species, *C. annularis*, was very brief and failed to include some important details. Jordan and Snyder (1901a) erected the genus *Chasmias* to include *Gobius dolichognathus* Hilgendorf and a new species, *Chasmias misakius* Jordan and Snyder, 1901, from Japan. Subsequently, Jordan (1901) noted that *Chasmias* Jordan and Snyder was preoccupied by *Chasmias* Ashmead, 1901, an insect genus, and substituted the name *Chasmichthys*. Two years later Jordan (1903) recognized *Chasmichthys misakius* as a junior synonym of *Saccostoma gulosus* Guichenot in Sauvage, 1882; but *Saccostoma* Guichenot in Sauvage, 1882 was preoccupied by *Saccostoma* Fitzinger, 1843, a reptile genus. Therefore, Jordan (1903) recognized the genus as *Chasmichthys*, including *C. gulosus* and *C. dolichognathus*. The genus remained unchanged until Stevenson (2000) suggested that it should be synonymized under *Chaenogobius*.

The nomenclatural changes proposed by Stevenson (2000) are here elaborated, providing a complete revision of both *Chaenogobius* and *Gymnogobius*, including the description of a new species from Japan, the Russian Far East, and the Kuril Islands. A summary of proposed changes is presented in Table 1.

Materials and Methods

Methods of counting scales follow Akihito *et al.* (1984). Dorsal pterygiophore formulae (DF), vertebral counts, and number of anal pterygiophores anterior to the first haemal spine (AP) follow Birdsong *et al.* (1988). The last ray of the second dorsal and anal fins is divided to its base, but counted here as one ray. The first caudal vertebral centrum is defined as the anteriormost centrum with a complete haemal arch. Cephalic sensory pore symbols (B=posterior nasal, C=anterior interorbital, D=posterior interorbital, F=postorbital, G=intermediate otic, H=extreme otic) follow Akihito *et al.* (1984). Sensory papillae nomenclature and symbols (*n*=anterior transverse row of occipital series, *f*=mental row, *lm*=lateral midline series) follow Sanzo (1911), as modified by Wongrat and Miller (1991). Institutional

Table 1. Species recognized in this study, their included nominal species, and their equivalents in Akihito *et al.* (1984) and Pinchuk (1984), listed in order of appearance in the text. **: species not included by this author.

Nominal species	Akihito *et al.* (1984)	Pinchuk (1984)	This study
Chaenogobius annularis Gill, 1859	*Chasmichthys dolichognathus*	**	*Chaenogobius annularis*
Gobius dolichognathus Hilgendorf, 1879			
Saccostoma gulosus Guichenot in Sauvage, 1882	*Chasmichthys gulosus*	**	*Chaenogobius gulosus*
Chasmias misakius Jordan and Snyder, 1901			
Gobius castaneus O'Shaughnessy, 1875	*Chaenogobius laevis*	*Rhodoniichthys laevis*	*Gymnogobius castaneus*
Chloea nakamurae Jordan and Richardson, 1907			
Chloea senbae Tanaka, 1916			
Chaenogobius taranetzi Pinchuk, 1978	**	*Chaenogobius taranetzi*	*Gymnogobius taranetzi*
Gobius breunigii Steindachner, 1880	*Chaenogobius castaneus*	*Chaenogobius castaneus*	*Gymnogobius breunigii*
Chaenogobius cylindricus Tomiyama, 1936	**	*Chaenogobius cylindricus*	*Gymnogobius cylindricus*
Chaenogobius scrobiculatus Takagi, 1957	*Chaenogobius cylindricus*	*Chaenogobius scrobiculatus*	*Gymnogobius scrobiculatus*
Gobius macrognathos Bleeker, 1860	*Chaenogobius macrognathus*	*Chaenogobius macrognathus*	*Gymnogobius macrognathos*
Gymnogobius raninus Taranetz, 1934			
Paleatogobius uchidai Takagi, 1957	*Chaenogobius uchidai*	*Paleatogobius uchidai*	*Gymnogobius uchidai*
Gobius heptacanthus Hilgendorf, 1879	*Chaenogobius heptacanthus*	*Chaenogobius heptacanthus*	*Gymnogobius heptacanthus*
Chloea sarchynnis Jordan and Snyder, 1901			
Chloea nigripinnis Wang and Wang, 1935			
Chloea mororana Jordan and Snyder, 1901	*Chaenogobius mororanus*	*Chaenogobius mororanus*	*Gymnogobius mororanus*
Chloea bungei Shmidt, 1931			
Chaenogobius isaza Tanaka, 1916	*Chaenogobius isaza*	*Chaenogobius isaza*	*Gymnogobius isaza*
Gobius petschiliensis Rendahl, 1924	*Chaenogobius* sp. 2	**	*Gymnogobius petschiliensis*
Chaenogobius transversefasciatus Wu and Zhou, 1990			
Gymnogobius opperiens n. sp.	*Chaenogobius* sp. 1	**	*Gymnogobius opperiens*
Gobius urotaenia Hilgendorf, 1879	*Chaenogobius urotaenia*	*Chaenogobius annularis*	*Gymnogobius urotaenia*
Gobius laevis Steindachner, 1880			
Chloea aino Shmidt, 1904			

abbreviations follow Leviton *et al.* (1985), with the exception of the Biological Laboratory of the Imperial Household in Tokyo, which is abbreviated BLIH. Measurements are straight-line distances determined using dial calipers or an ocular micrometer, and standard length (SL) is used throughout. Meristics in species accounts are given as ranges, with modal counts, when a clear mode exists, indicated in parentheses. For *G. opperiens* n. sp. and *G. scrobiculatus* (Takagi, 1957), meristics are given as ranges, with counts for the holotype (or neotype) in bold, followed by modal count in parentheses. Meristic frequency distributions for all species included in this study are given in Tables 2–4, and a summary of scale counts is given in Table 5.

Systematics

Genus ***Chaenogobius*** Gill, 1859

Chaenogobius Gill, 1859: 12 (type species: *Chaenogobius annularis* Gill, 1859, by monotypy).

Saccostoma Guichenot in Sauvage, 1882: 171 (type species: *Saccostoma gulosus* Guichenot in Sauvage, 1882, by monotypy), preoccupied by *Saccostoma* Fitzinger, 1843, a genus of Squamata.

Chasmias Jordan and Snyder, 1901a: 761 (type species: *Chasmias misakius* Jordan and Snyder, 1901, by original designation), preoccupied by *Chasmias* Ashmead, 1901, a genus of Insecta.

Chasmichthys Jordan, 1901: 941 (type species: *Chasmias misakius* Jordan and Snyder, 1901, by original designation). **N. syn.**

Diagnosis. Anteriormost pterygiophore of first dorsal fin inserted in fourth (rarely fifth) interneural space; tongue emarginate; cheeks and opercles without scales; predorsal scales extending anteriorly beyond posterior margin of opercle; posterior oculoscapular and preopercular canals absent; dorsal rays of pectoral fin divided into 10–20 fine, filamentous projections free from fin membrane (Fig. 1); anterior oculoscapular canals present, connected in posterior interorbital space by short transverse commissure, opening through single medial D pore and paired B, F, and H pores; gill opening confined to side of head; scales cycloid (except in some specimens of <30 mm SL).

Description. Body elongate, cylindrical anteriorly, becoming compressed posteriorly; scales small and cycloid (except in some specimens of <30 mm SL), covering entire body including belly, extending anteriorly on dorsum beyond origin of first dorsal fin. Genital papilla small and ovoid, with no apparent external sexual dimorphism.

Head broad, depressed, without barbels, its widest point near preopercle; snout rounded in dorsal profile, bluntly pointed in lateral profile. Head without scales. Eyes directed laterally and slightly upward, set anteriorly in head; interorbital space broad and flat. Anterior nares opening through short, tubular projections; posterior nares flush with snout. Mouth very large; upper jaw extending anteriorly beyond lower; maxilla extending posteriorly well beyond posterior margin of orbit; fleshy flap overlapping middle third of maxilla. Premaxillary and dentary teeth conical, slightly curved, arranged in several irregular rows; canines absent;

Table 2. Frequency distribution of first dorsal fin, second dorsal fin, and anal fin ray counts for known species of *Chaenogobius* and *Gymnogobius*.

Species	First dorsal fin				Second dorsal fin						Anal fin					
	V	VI	VII	VIII	I,09	I,10	I,11	I,12	I,13	I,14	I,08	I,09	I,10	I,11	I,12	I,13
C. annularis	3	41			5	29	9				5	35	2			
C. gulosus	3	31			1	11	21				2	23	8			
G. castaneus		2	56	16	16	46	11				1	20	40	12	1	
G. taranetzi			30	4		20	14					5	25	3		
G. breunigii			52	21	1	49	24					7	54	12		
G. cylindricus		4					1	1	2				3	1		
G. scrobiculatus		11				10	1					10	1			
G. macrognathos	2	21	3			3	14	9				2	13	10		
G. uchidai	2	16				8	10					4	11	3		
G. heptacanthus			23			1	4	17						3	11	9
G. mororanus			48	7		2		31	19	2		1		4	36	15
G. isaza	1	24	1			12	11	1				3	20	2		
G. petschiliensis	1	51	5		11	43	3					13	39	4		
G. opperiens	7	142	5			3	121	27	3			2	57	89	5	1
G. urotaenia	17	101	11		7	52	64	6				7	89	32		

Table 3. Frequency distribution of abdominal vertebrae, caudal vertebrae, and AP (number of anal fin pterygiophores preceding first haemal spine) counts for known species of *Chaenogobius* and *Gymnogobius*.

Species	Abdominal vertebrae				Caudal vertebrae								AP		
	14	15	16	17	16	17	18	19	20	21	22	23	2	3	4
C. annularis	34						24	10					17	2	
C. gulosus	23	5					3	25					9	19	
G. castaneus		8	51				3	20	33	3			2	41	14
G. taranetzi		2	31					8	23	2			1	31	
G. breunigii		17	40					15	36	6			3	24	29
G. cylindricus		4					4						4		
G. scrobiculatus		11					11						10	1	
G. macrognathos			25				2	19	4				20	4	
G. uchidai		17	1				1	17					5	13	
G. heptacanthus		1	6	16					6	16	1			8	3
G. mororanus			42	10				1		7	34	10		30	3
G. isaza	7	31				2	27	9					3	20	1
G. petschiliensis	3	40	4	1	1	40	7						1	45	2
G. opperiens	1	142	8			4	137	10					15	68	10
G. urotaenia		5	110	4	1	48	67	3					4	53	2

Table 4. Frequency distribution of first dorsal-fin pterygiophore formulae for known species of *Chaenogobius* and *Gymnogobius*.

Species	4-2221100	4-22211000	4-2220100	4-2212100	4-22121000	4-21211100	4-2121100	4-21211000	4-212110000	4-2120100	4-21201000	4-212010000	4-21121100	4-21121000	4-2111100	4-13121000	4-122210000	4-12212000	4-122120000	4-12211100	4-122111000	4-12211010	4-122110100	4-1221100
C. annularis																								
C. gulosus																								
G. castaneus		1						4								1		1		1		1		
G. taranetzi								1						1						1				1
G. breunigii	1	1		1	1	1	1	7					1	2			1	1		4				
G. cylindricus																								
G. scrobiculatus											1													
G. macrognathos											2	1												
G. uchidai											1													
G. heptacanthus								1																
G. mororanus									5								1		1		1		1	
G. isaza										3					2									1
G. petschiliensis										3														
G. opperiens			2							1	2				1									
G. urotaenia																								

Table 4. Continued.

Species	4-12211000	4-122110000	4-1221010	4-12210100	4-122101000	4-1221000	4-12210000	4-122100000	4-1220100	4-12201000	4-122010000	4-1212110	4-12121100	4-121211000	4-12121010	4-12121000	4-121210000	4-12120100	4-121201000	4-12120000	4-1211110	4-1211100	4-12111000	4-121110000
C. annularis									3													24		
C. gulosus									1													19		
G. castaneus	14	2		1								1	4	1	1	9		11	2					
G. taranetzi	7												2	1		12		2						
G. breunigii	11			1									4	2		14								
G. cylindricus									2	1														
G. scrobiculatus										1													8	
G. macrognathos	2							1	1	8	3							1					3	
G. uchidai							1			12														
G. heptacanthus	3	11			1												1		1					
G. mororanus	2	30											1											
G. isaza									3	1												8	3	
G. petschiliensis					1	3			24										2	1		9	1	1
G. opperiens			1			2			72	13											1	27	3	
G. urotaenia			1						4	9								1		1		5	9	

(To be continued)

Table 4. Continued.

Species	4-121101000	4-1211000	4-12110000	4-12101000	4-113111000	4-113110000	4-1130100	4-11221100	4-11221000	4-112210000	4-11220100	4-112201000	4-1121100	4-11211000	4-112110000	4-1121000	4-1120100	4-1111100	4-11111000	5-3211000000	5-3201000	5-2221000	5-22210000	5-2220100
C. annularis		1											4				1							
C. gulosus													6											
G. castaneus								1	1					1										
G. taranetzi									4		1													
G. breunigii									1															
G. cylindricus																								
G. scrobiculatus														1										
G. macrognathos	1		1																					
G. uchidai				1																	2			
G. heptacanthus										1		1												
G. mororanus					1	1				3										1			1	
G. isaza													1					1						
G. petschiliensis		1										1												
G. opperiens		3					1						6	4		1	1		1					
G. urotaenia			1										4	17	1							1		2

Table 4. Continued.

Species	5-2211100	5-221100	5-2211000	5-2210100	5-2202000	5-220100	5-2201000	5-2121000	5-2120100	5-21201000	5-211100	5-2111000	5-2110100	5-21101000	5-1311000	5-1221000	5-121100	5-1211000	5-1210100	5-1121100	6-221100
C. annularis																					
C. gulosus											1						1				
G. castaneus																					
G. taranetzi																					
G. breunigii																					
G. cylindricus			1																		
G. scrobiculatus																					
G. macrognathos							1														
G. uchidai							1														
G. heptacanthus																					
G. mororanus																					
G. isaza																					
G. petschiliensis																					
G. opperiens						1															
G. urotaenia	2	5	20	2	1			2	4	1		3	1	1	2	2		9	2	1	1

Table 5. Summary of scale count ranges for known species of *Chaenogobius* and *Gymnogobius*. Asterisks (*) indicate that counts could not be reliably obtained for the material examined due to the small size, embedded position, or irregular placement of the scales.

Species	Lateral scales	Transverse scales	Predorsal scales
Chaenogobius annularis	61–67	20–22	17–24
Chaenogobius gulosus	77–87	29–36	28–44
Gymnogobius castaneus	60–69	15–20	0–12
Gymnogobius taranetzi	62–67	17–21	0–6
Gymnogobius breunigii	60–71	16–19	0–9
Gymnogobius cylindricus	~50–60*	~10–12*	0
Gymnogobius scrobiculatus	~50–60*	~10–12*	0
Gymnogobius macrognathos	~45–50*	~8–12*	0
Gymnogobius uchidai	~45–50*	~10–15*	0
Gymnogobius heptacanthus	67–75	17–19	1–3
Gymnogobius mororanus	89–101	25	0–8
Gymnogobius isaza	57–65	13–18	0
Gymnogobius petschiliensis	62–72	18–22	22–31
Gymnogobius opperiens	71–78	20–21	19–26
Gymnogobius urotaenia	66–76	19–22	20–30

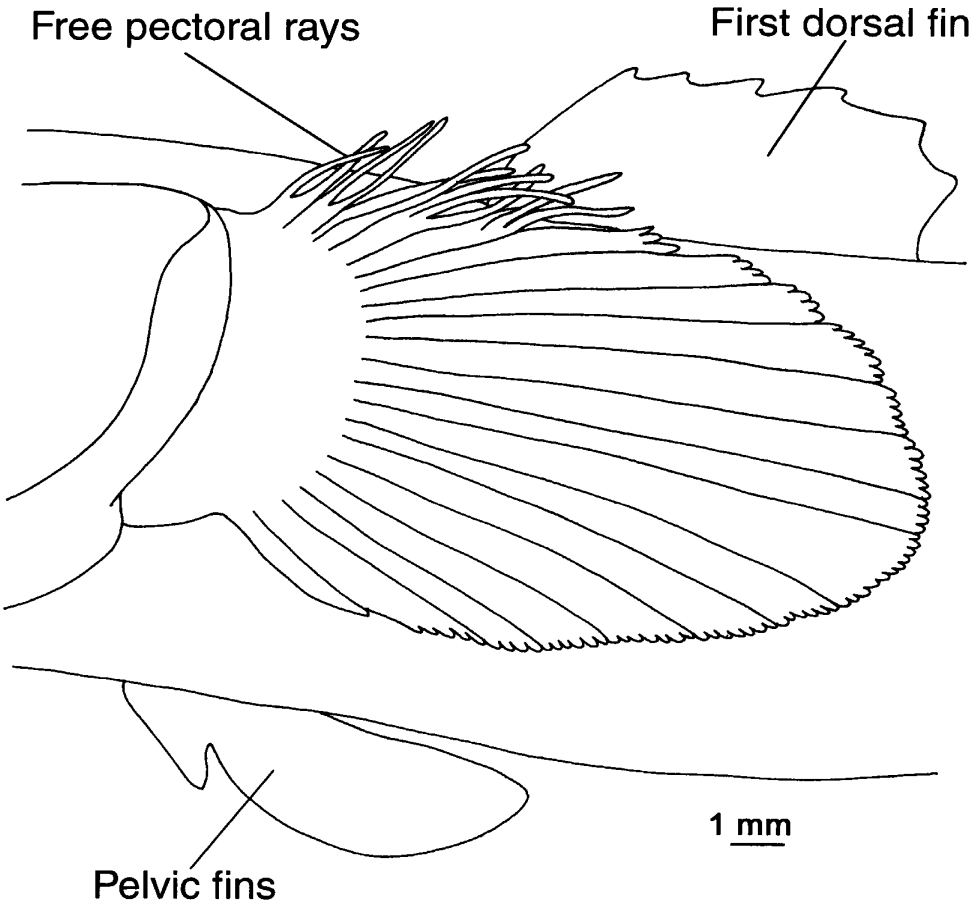

Fig. 1. Pectoral fin of *Chaenogobius annularis*, HUMZ 154885, 52.2 mm SL (anterior to the left).

tongue emarginate. Anterior oculoscapular canals present, opening through minute pores; left and right canals connected by short transverse commissure in posterior interorbital space; posterior oculoscapular and preopercular canals and pores absent. Sensory papillae pattern invariable: four longitudinal rows of papillae on cheek, no transverse rows on cheek, no papillae in interorbital space. Gill opening short, vertical, extending anteroventrally just beyond base of pectoral fin; gill membranes attached at isthmus; branchiostegal rays five.

Two dorsal fins, separated, not connected by membrane, approximately equal in height. First dorsal fin short, somewhat rounded in profile, consisting of six spines (rarely five), anteriormost pterygiophore inserted in fourth (rarely fifth) interneural space; DF somewhat variable, most commonly 4-1211100. Second dorsal fin with one spine and 9–11 soft rays, posteriormost ray divided to its base, anteriormost pterygiophore usually inserted in 11th interneural space. Anal fin approximately equal to second dorsal fin in height, its length somewhat shorter than second dorsal fin, its origin posterior to origin of second dorsal fin; consisting of one spine and 8–10 soft rays, posteriormost ray divided to its base; two or three anal fin pterygiophores preceding first haemal spine. Caudal fin rounded, consisting of 17 segmented rays (nine dorsal + eight ventral), 15 of these being branched (eitht dorsal + seven ventral), and several dorsal and ventral unsegmented rays; epurals two. Pectoral fins large, rounded, extending posteriorly beyond midpoint of first dorsal fin, consisting of 21–24 rays; dorsalmost rays forming 10–20 fine filaments, each free from fin membrane. Pelvic fins short, rounded, completely fused to each other, consisting of one spine and five soft rays; pelvic frenum fleshy, its posterior margin concave, with deep notch between spine and lateralmost soft ray on each side (Fig. 2A).

Two species, often found sympatrically in rocky tide pools along the coasts of Japan and Korea.

Key to Species of *Chaenogobius*

1. Scales in longitudinal series 61–67, scales in transverse series 20–22, predorsal scales 17–24; one pair of sensory papillae in row *f* (Fig. 3A); modal second dorsal-fin ray count I,10; modal AP 2; modal vertebral count 14+18 ..... *C. annularis* (p. 259)
– Scales in longitudinal series 77–87, scales in transverse series 29–36, predorsal scales 28–44; three pairs of sensory papillae in row *f* (Fig. 3B); modal second dorsal-fin ray count I,11; modal AP 3; modal vertebral count 14+19 ..... *C. gulosus* (p. 262)

Chaenogobius annularis Gill, 1859

[Japanese name *agohaze*; Korean name *jeom-mang-dug*]

(Figs 4A, 5A)

Chaenogobius annularis Gill, 1859: 13–14 (type locality: "Hakodadi" Bay, Japan).
Gobius annularis: Günther 1861: 65–66.
Gobius dolichognathus Hilgendorf, 1879: 108 (type localtiy: Japan). [Synonymized

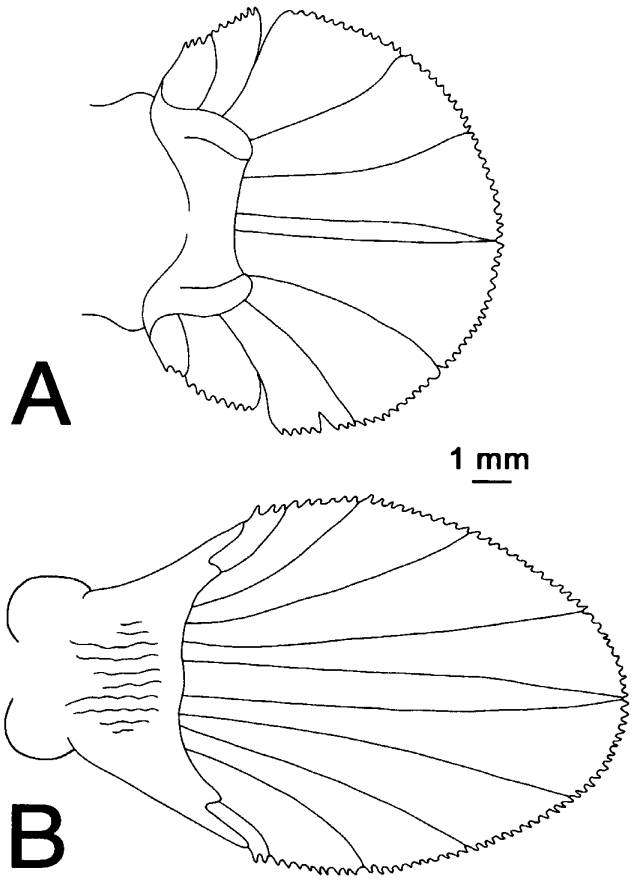

Fig. 2. Ventral view of pelvic fins. A, *Chaenogobius gulosus*, HUMZ 99330, 75.9 mm SL; B, *Gymnogobius urotaenia*, HUMZ 40727, 91.1 mm SL.

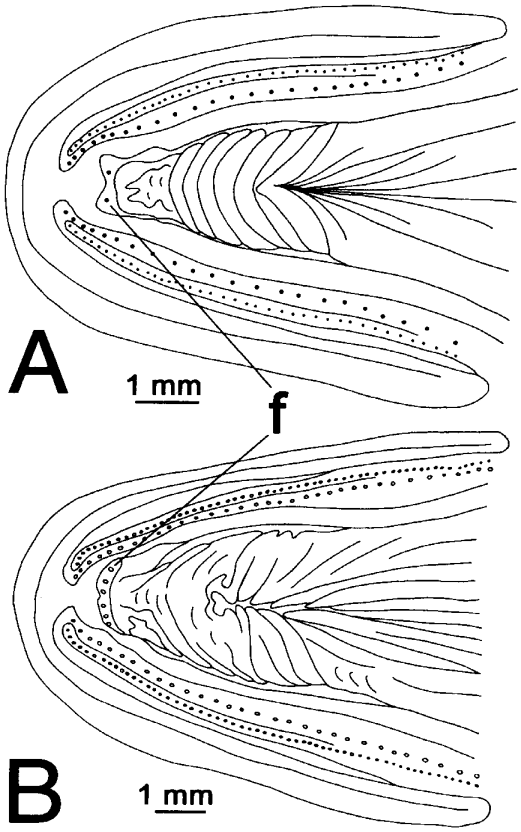

Fig. 3. Ventral aspect of chin. A, *Chaenogobius annularis*, LACM 44905-2, 43.5 mm SL; B, *C. gulosus*, LACM 44905-2, 62.0 mm SL. *f*=mental row of sensory papillae.

by Stevenson (2000)]

Chasmias dolichognathus: Jordan and Snyder 1901a: 764.

Chasmichthys dolichognathus: Jordan 1901: 941 (replacement name for *Chasmias dolichognathus*).

Chasmichthys dolichognathus dolichognathus: Tomiyama 1936: 93. [Synonymized by Stevenson (2000)]

Type material. *Chaenogobius annularis*: USNM 6336, holotype, 40.6 mm, "Hakodadi" Bay, Japan, Stimpson. *Gobius dolichognathus*: ZMB 10651, holotype, 44.0 mm, Japan, Hilgendorf; ZMB 10654, paratypes, 9 (27.5–55.9 mm), Japan, Hilgendorf.

Additional material. BMNH 1903.5.14.65-74, 38.0 mm, Misaki, Sagami, Honshu, Japan, Jordan; HUMZ 99287, 44.3 mm, Oshoro, Japan, Izutsu; HUMZ 99333, 47.1 mm, Oshoro, Japan, Izutsu; HUMZ 103018, 47.1 mm, Horonai, Okushiri Island, Japan, Miki, Nishida, and Maeda; HUMZ 152150, 42.1 mm, Cape Shiokubi, Toi, Hokkaido, Japan, Okada; HUMZ 152153, 41.2 mm, Cape Shiokubi, Toi, Hokkaido, Japan, Okada; HUMZ 152155, 46.5 mm, Kaminokuni, Hokkaido, Japan, Okada;

HUMZ 152156, 42.5 mm, Kaminokuni, Hokkaido, Japan, Okada; HUMZ 152338, 45.0 mm, Cape Shirakami, Matsumae, Hokkaido, Japan, Okada; HUMZ 152339, 40.7 mm, Cape Shirakami, Matsumae, Hokkaido, Japan, Okada; HUMZ 154885, 52.2 mm, Anama, Hakodate, Hokkaido, Japan; HUMZ 154887, 30.4 mm, Anama, Hakodate, Hokkaido, Japan; HUMZ 154889, 26.4 mm, Kandahama, Okushiri Island, Japan; HUMZ 154894, 25.5 mm, Kandahama, Okushiri Island, Japan; HUMZ 154916, 38.5 mm, Cape Shiokubi, Toi, Hokkaido, Japan; HUMZ 154918, 39.0 mm, Cape Shiokubi, Toi, Hokkaido, Japan; HUMZ 154919, 39.8 mm, Cape Shiokubi, Toi, Hokkaido, Japan; LACM 44905-2, 43.5 mm, Misaki, Japan; NMW 30768, 40.6 mm, Hakodate, Hokkaido, Japan, Steindachner; NSMT-P 19363, 24 (40.5–52.5 mm), Tsumakizaki, Izu Peninsula, Honshu, Japan, Matsuura; NSMT-P 23159, 48.0 mm, Tobi-shima Island, Yamagata Pref., Japan, Arai, Matsuura, and Aizawa; NSMT-P 45880, 2 (44.5–44.6 mm), Izu, Miyake-jima Island, Japan, Shibukawa; NSMT-P 56774, 8 (29.0–57.0 mm), Iwai-zaki Point, Kesennuma, Miyagi, Honshu, Japan, Matsuura and Shibukawa.

Diagnosis. Species of *Chaenogobius* unique in having 61–67 scales in longitudinal series, 20–22 scales in transverse series, 17–24 predorsal scales; one pair of sensory papillae in row *f*; modal second dorsal-fin ray count I,10; modal AP 2; modal vertebral count 14+18; dorsal fins light brown with distinct dark-brown, wavy longitudinal bands; caudal and pectoral fins light brown with distinct dark-brown transverse bands; body and head light brown with approximately six broad and dark transverse bands, several small, black spots, and distinct dark blotch at caudal fin base.

Description. Body robust, cylindrical anteriorly, becoming compressed posteriorly; caudal peduncle deep. Scales small, cycloid (except some specimens of <30 mm SL possessing many ctenoid scales), covering entire body from posterior margin of opercle to caudal fin, extending anterior to first dorsal fin along dorsal midline; head naked; scales in longitudinal series 61–67, scales in transverse series 20–22, predorsal scales 17–24. Several rows of sensory papillae in abdominal region; approximately 28 vertical rows of sensory papillae in *lm* series.

Head broad and depressed, with broad bulge on snout; interorbital space broad and flat, its width greater than orbital diameter; mouth large, subterminal; upper jaw protruding beyond lower jaw; maxilla extending posteriorly beyond posterior margin of orbit and beyond perimeter of gape, its posterior end not attached to cheek; small, sharp, conical premaxillary and dentary teeth in irregular rows; canine teeth absent; tongue emarginate; posterolateral end of mental flap indistinct, continuous posteriorly; no fleshy, barbel-like processes behind chin; single pair of sensory papillae in row *f*; gill opening short, vertical, extending anteroventrally just beyond base of pectoral fin. Anterior oculoscapular canals connected by short transverse commissure in posterior interorbital space, opening through paired B, F, and H pores and single medial D pore (Fig. 4A); four suborbital rows of sensory papillae oriented longitudinally; one sensory papilla in row *n*, directly dorsal to F pore.

Dorsal fins approximately equal in height and separated, not connected by membrane; first dorsal fin V–VI (VI); DF somewhat variable, modally 4-1211100; second dorsal fin I,9–11 (I,10); anal fin I,8–10 (I,9); AP 2–3 (2); pectoral fins large, rounded, extending posteriorly beyond midpoint of first dorsal fin, consisting of 21–23 (22) rays; dorsalmost rays forming 10–20 fine filaments, each free from fin

membrane; pelvic fins I,5, united with complete and fleshy frenum with deep notch separating distal portion of spine and first soft ray; segmented caudal fin rays 9+8, branched caudal fin rays 8+7; vertebrae 14+18–19 (14+18).

Color in alcohol. Head and body light brown with small, dark-brown or black spots, 5–7 broad, dark-brown vertical bands, and large, dark blotch at base of pectoral and caudal fins. First dorsal fin light brown with several distinct dark-brown longitudinal bands and large, dark blotch near posterior margin; second dorsal fin light brown with several distinct longitudinal wavy bands; anal fin medium brown with indistinct dark blotches; caudal and pectoral fins light brown with several transverse rows of distinct dark-brown speckles.

Distribution. Specimens examined are from several localities on southern Hokkaido and western Honshu, as well as Okushiri, Tobi-shima, and Miyake-jima Islands. Akihito *et al.* (1984) reported this species from Hokkaido to Tanegashima in Japan. Mori (1928) reported it from Wonsan in (present-day) North Korea and Kim *et al.* (1987) reported it throughout coastal South Korea.

Remarks. Since 1903 this species has been referred to as *Chasmichthys dolichognathus*, while the name *Chaenogobius annularis* has been incorrectly used for several different species (see species accounts under *Gymnogobius*). This confusion was the result of the brevity of the original description of *C. annularis* and the mistaken assumption that the holotype was lost. After discovering the holotype, Stevenson (2000) showed that *Chaenogobius annularis* Gill is a senior synonym of *Gobius dolichognathus* Hilgendorf.

Comparative remarks. *Chaenogobius annularis* attains a much smaller maximum size than *C. gulosus*. The largest specimen examined in this study was under 56 mm. Large specimens have only cycloid scales but some of the smaller individuals examined (<30 mm) have many ctenoid scales, particularly on the caudal peduncle. *Chaenogobius annularis* can be distinguished from *C. gulosus* by color pattern, lower scale counts and meristics, and row *f* sensory papillae pattern.

Chaenogobius gulosus (Guichenot in Sauvage, 1882), n. comb.
[Japanese name *dorome*; Korean name *byeol-mang-dug*]
(Figs 4B, 5B)

Saccostoma gulosus Guichenot in Sauvage, 1882: 171 (type locality: Japan).
Chasmias misakius Jordan and Snyder, 1901a: 761, pl. 36 (type locality: Misaki, Sagami, Honshu, Japan). [Synonymized by Jordan (1903)]
Chasmichthys misakius: Jordan 1901: 941 (replacement name for *Chasmias misakius*).
Chasmichthys gulosus: Jordan 1903: 696.
Chaemichthys [sic] *gulosus*: Wang and Wang 1935: 189–190, fig. 18.
Chasmichthys dolichognathus gulosus: Tomiyama 1936: 93.

Type material. *Saccostoma gulosus*: MNHN 5121, holotype, 117.1 mm, Japan, Eloffe. *Chasmias misakius*: BMNH 1903.5.14.65-74, "cotypes," 26 (38.5–103.0 mm), Misaki, Sagami, Honshu, Japan, Jordan.

Additional material. HUMZ 99296, 76.2 mm, Oshoro, Japan, Izutsu; HUMZ 99330, 75.9 mm, Oshoro, Japan, Izutsu; HUMZ 99331, 78.0 mm, Oshoro, Japan,

Izutsu; HUMZ 99332, 80.5 mm, Oshoro, Japan, Izutsu; HUMZ 100392, 77.6 mm, Oshoro, Japan, Izutsu; HUMZ 103008, 45.0 mm, Horonai, Okushiri Island, Japan, Miki, Nishida, and Maeda; HUMZ 103011, 39.4 mm, Horonai, Okushiri Island, Japan, Miki, Nishida, and Maeda; HUMZ 103012, 39.0 mm, Horonai, Okushiri Island, Japan, Miki, Nishida, and Maeda; HUMZ 103013, 39.5 mm, Horonai, Okushiri Island, Japan, Miki, Nishida, and Maeda; HUMZ 154908, 26.5 mm, Kandahama, Okushiri Island, Japan; HUMZ 154909, 30.5 mm, Kandahama, Okushiri Island, Japan; HUMZ 154910, 26.2 mm, Kandahama, Okushiri Island, Japan; LACM 1063, 89.6 mm, Misaki, Japan; LACM 44905-1, 2 (31.5–74.5 mm), Misaki, Japan; LACM 44905–2, 9 (58.0–87.5 mm), Misaki, Japan; NSMT-P 23147, 5 (33.4–44.2 mm), Tobishima Island, Japan, Arai; NSMT-P 50675, 16 (34.3–83.9 mm), NE coast of Hegurajima Island, Japan, Matsuura.

Diagnosis. Species of *Chaenogobius* unique in having 77–87 scales in longitudinal series, 29–36 scales in transverse series, 28–44 predorsal scales; three pairs of sensory papillae in row *f*; modal second dorsal-fin ray count I,11; modal AP 3; modal vertebral count 14+19; dorsal fins dark brown with indistinct black blotches, second dorsal fin with white margin; caudal and anal fin dark brown with white margin; pectoral fin dusky without distinct bands; body and head dark brown, mottled with lighter areas and, in life, white spots; indistinct dark blotch at caudal fin base.

Description. Body robust, cylindrical anteriorly, becoming compressed posteriorly; caudal peduncle deep. Scales small, cycloid, covering entire body from posterior margin of opercle to caudal fin, extending anterior to first dorsal fin along dorsal midline; head naked; scales in longitudinal series 77–87, scales in transverse series 29–36, predorsal scales 28–44. Several rows of sensory papillae in abdominal region; 28–30 vertical rows of sensory papillae in *lm* series.

Head broad and depressed, with broad bulge on snout; interorbital space broad and flat, its width greater than orbital diameter; mouth large, subterminal; upper jaw protruding beyond lower jaw; maxilla extending posteriorly beyond posterior margin of orbit and beyond perimeter of gape, its posterior end not attached to cheek; small, sharp, conical premaxillary and dentary teeth in irregular rows; canine teeth absent; tongue emarginate; posterior end of mental flap indistinct, continuous posteriorly; no fleshy, barbel-like processes behind chin; three pairs of sensory papillae in row *f*; gill opening short, vertical, extending anteroventrally just beyond base of pectoral fin. Anterior oculoscapular canals connected by short transverse commissure in posterior interorbital space, opening through paired B, F, and H pores and single medial D pore (Fig. 4A); four suborbital rows of sensory papillae oriented longitudinally; one sensory papilla in row *n*, directly dorsal to F pore.

Dorsal fins approximately equal in height and separated, not connected by membrane; first dorsal fin V–VI (VI); DF somewhat variable, modally 4-1211100; second dorsal fin I,9–11 (I,11); anal fin I,8–10 (I,9); AP 2–3 (3); pectoral fins large, rounded, extending posteriorly beyond midpoint of first dorsal fin, consisting of 21–23 (22) rays; dorsalmost rays forming 10–20 fine filaments, each free from fin membrane; pelvic fins I,5, united with complete and fleshy frenum, with deep notch separating distal portion of spine and first soft ray; segmented caudal fin rays 9+8, branched caudal fin rays 8+7; vertebrae 14–15+18–19 (14+19).

Color in alcohol. Head and body dark brown with light brown mottling, be-

coming lighter on ventral surface, with large, indistinct dark blotch at base of caudal fin. First dorsal fin medium brown with indistinct dark-brown longitudinal bands throughout and large, dark blotch near posterior margin; second dorsal, anal, and caudal fins medium brown with narrow white margin; pectoral fin dusky brown.

Distribution. Specimens examined are from southeastern Hokkaido, the Pacific side of central Honshu, and Okushiri, Tobi-shima, and Hegura-jima Islands. Akihito *et al.* (1984) reported this species from Hokkaido to Kyushu in Japan. It has also been reported from Wonsan (Mori 1928), Quelpart (i.e. Cheju) Island (Uchida and Yabe 1939), coastal South Korea (Kim *et al.* 1987), and Tsingtao (i.e. Qingdao) on the Chinese coast (Wang and Wang 1935).

Remarks. The BMNH lot labeled "cotypes" of *Chasmias misakius* by Jordan is somewhat problematic. Jordan and Snyder (1901a) based their description of this species on ten specimens, one of which they established as the holotype (SU 6484). The BMNH lot of "cotypes" includes not nine, but 27 specimens, the smallest of which is actually *Chaenogobius annularis*. It is difficult to determine which specimens Jordan and Snyder (1901a) were using in their description, but they did include the measurements of the types, and all were larger than the single specimen of *C. gulosus* that is now part of the BMNH lot; therefore, that specimen, and probably most of the others, was not part of the original type series.

Comparative remarks. The largest specimen of *C. gulosus* examined was over 117 mm SL, and many specimens were significantly larger than the maximum size of *C. annularis*. Although several specimens of <30 mm were examined, ctenoid scales were not observed in this species, in contrast to *C. annularis*. In addition, *C. gulosus* generally has a darker body and fins than *C. annularis*, has higher scale counts and meristic counts, and a different row *f* sensory papillae pattern.

Genus ***Gymnogobius*** Gill, 1863

Gymnogobius Gill, 1863: 269 (type species: *Gobius macrognathos* Bleeker, 1860, by monotypy).

Chloea Jordan and Snyder, 1901b: 78–79 (type species: *Gobius castaneus* O'Shaughnessy, 1875, by original designation, considered by Whitley (1940) to be preoccupied by *Chloeia* Savigny in Lamarck, 1818, a genus of Polychaeta). [Synonymized by Tomiyama (1936)]

Chloeichthys Whitley, 1940: 243 (unnecessary replacement name for *Chloea* Jordan and Snyder, 1901).

Paleatogobius Takagi, 1957: 117–118 (type species: *Paleatogobius uchidai* Takagi, 1957, by monotypy). [Synonymized by Akihito *et al.* (1984)]

Rhodoniichthys Takagi, 1966b: 39 (type species: *Gobius laevis* Steindachner, 1880, by monotypy and by original designation). [Synonymized by Akihito *et al.* (1984)]

Diagnosis. Anteriormost pterygiophore of first dorsal fin inserted in fourth (rarely fifth) interneural space; tongue emarginate; cheeks and opercles without scales; extent of predorsal scales highly variable; posterior oculoscapular and preopercular canals absent; pectoral fin without filamentous projections; anterior

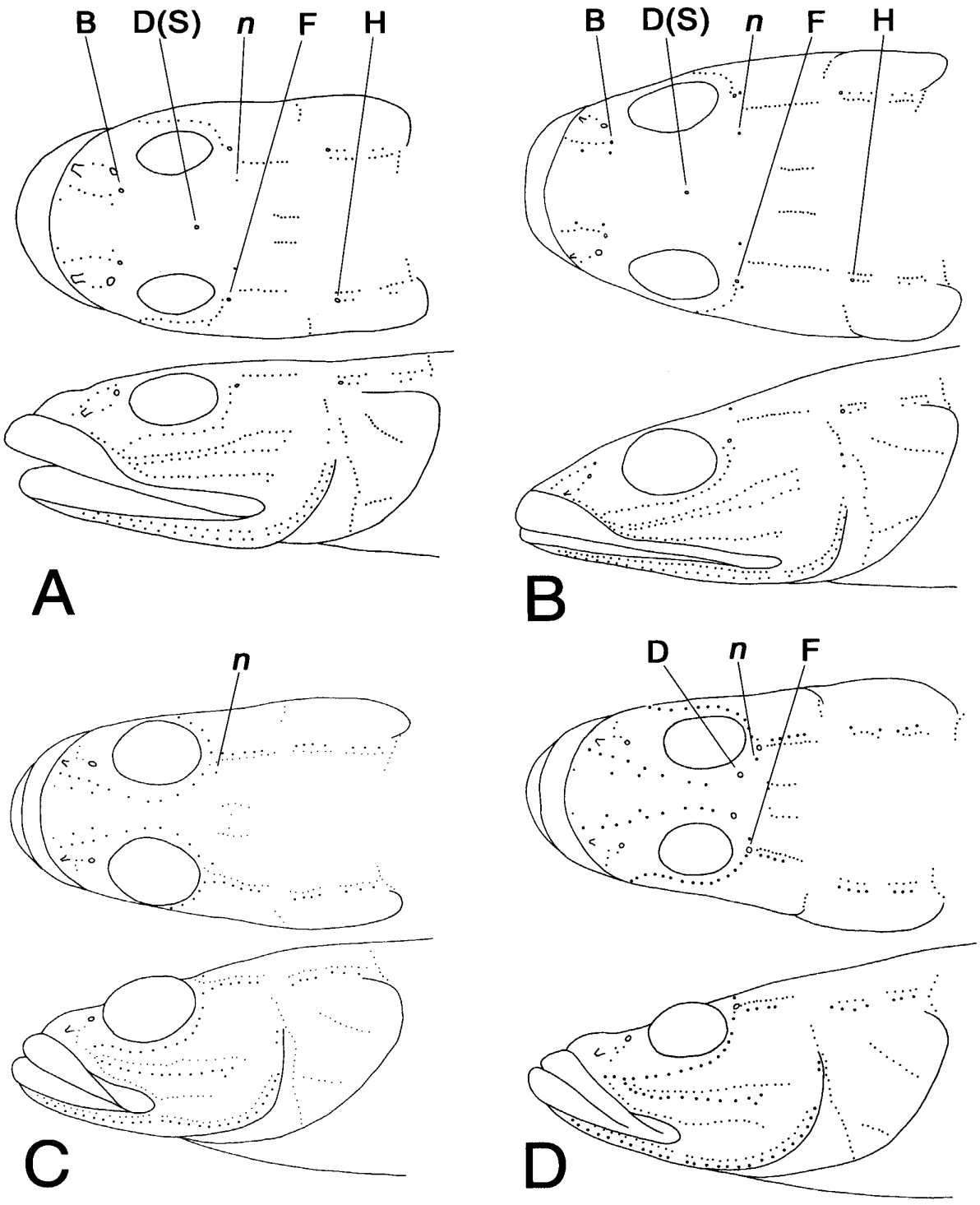

Fig. 4A–D. Dorsal and lateral aspects of head detailing oculoscapular canal pore and sensory papillae morphology. A, *Chaenogobius annularis*, HUMZ 154885, 52.2 mm SL; B, *C. gulosus*, LACM 44905-2, 58.5 mm SL; C, *Gymnogobius castaneus*, UW 029332, 40.4 mm SL; D, *G. taranetzi*, UW 044224, 61.3 mm SL. B, posterior nasal pores; D (S), single medial posterior interorbital pore; D, paired posterior interorbital pores; F, postorbital pores; H, extreme otic pores; *n*, anterior transverse row of occipital series of sensory papillae.

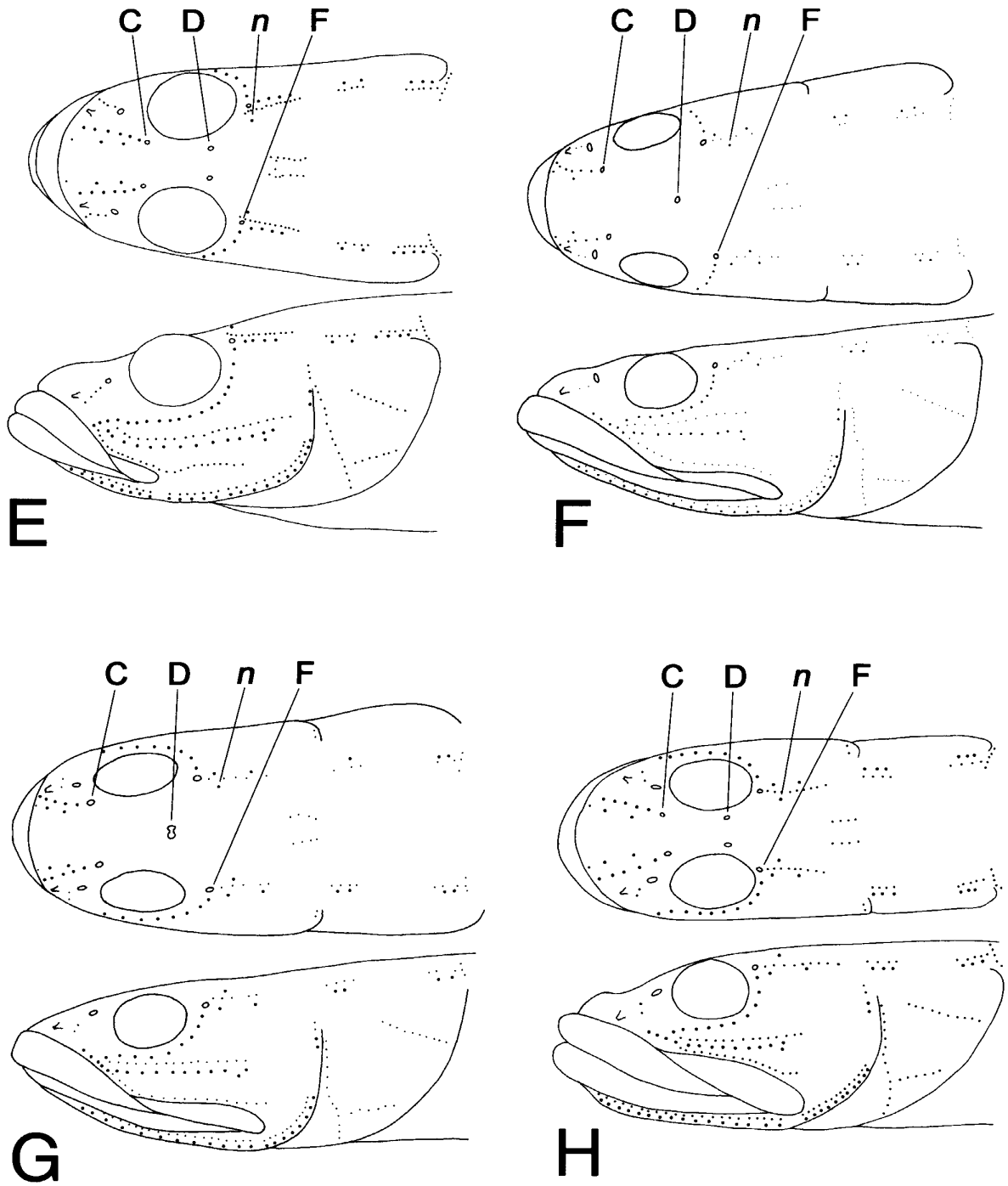

Fig. 4E–H. Dorsal and lateral aspects of head detailing oculoscapular canal pore and sensory papillae morphology. E, *Gymnogobius breunigii*, UW 029281, 42.5 mm SL; F, *G. cylindricus*, BLIH 1993284, 52.0 mm SL; G, *G. scrobiculatus*, BLIH 19891183, 33.8 mm SL; H, *G. macrognathos*, NSMT SK 5002, 26.0 mm SL. C, anterior interorbital pores; D, paired posterior interorbital pores; F, postorbital pores; *n*, anterior transverse row of occipital series of sensory papillae.

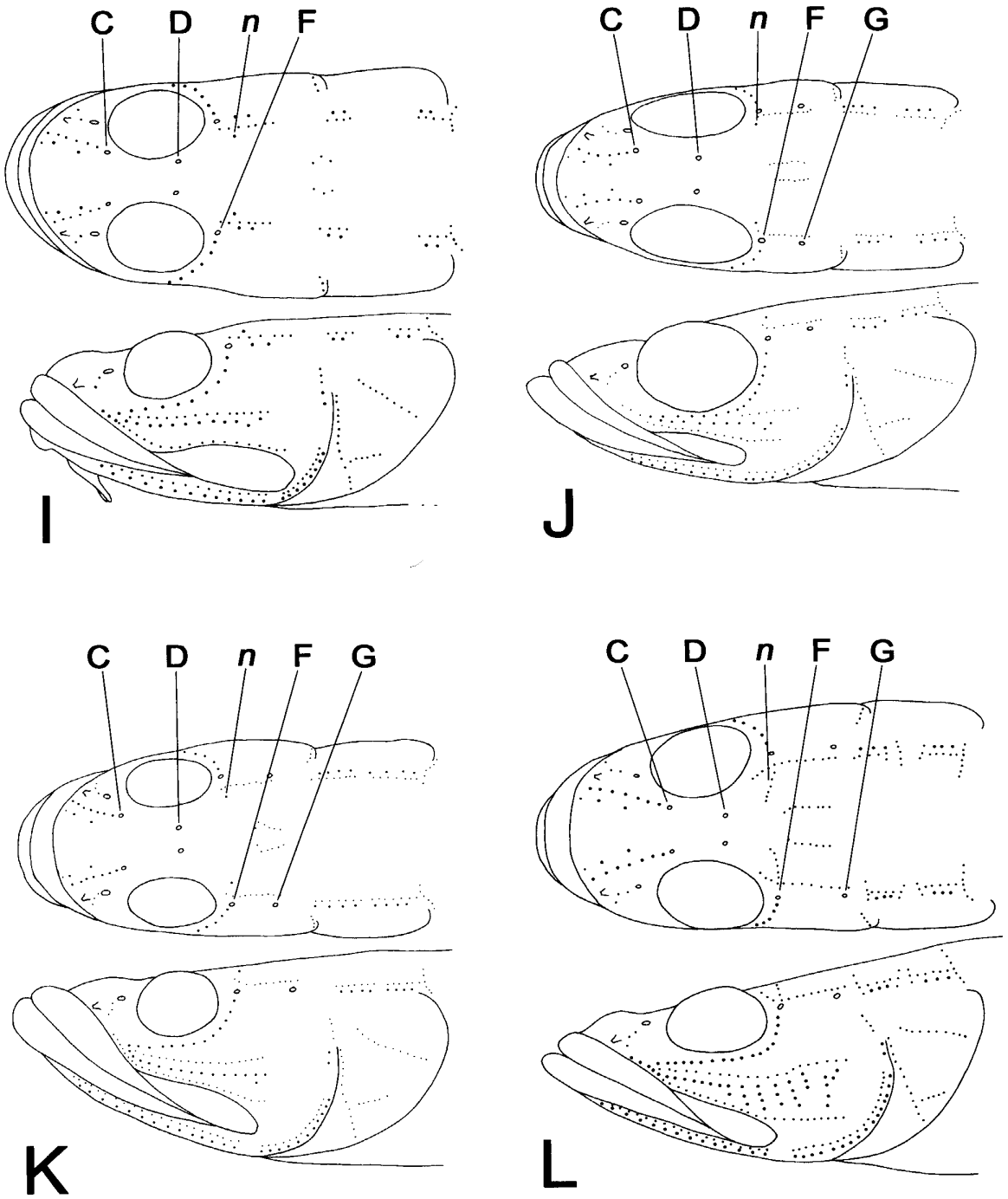

Fig. 4I–L. Dorsal and lateral aspects of head detailing oculoscapular canal pore and sensory papillae morphology. I, *Gymnogobius uchidai*, BLIH 1990120, 27.0 mm SL; J, *G. heptacanthus*, LACM 44370-2, 34.5 mm SL; K, *G. mororanus*, CAS 106619, paratype, 55.4 mm SL; L, *G. isaza*, UW 07817, 47.0 mm SL. C, anterior interorbital pores; D, paired posterior interorbital pores; F, postorbital pores; G, intermediate otic pores; *n*, anterior transverse row of occipital series of sensory papillae.

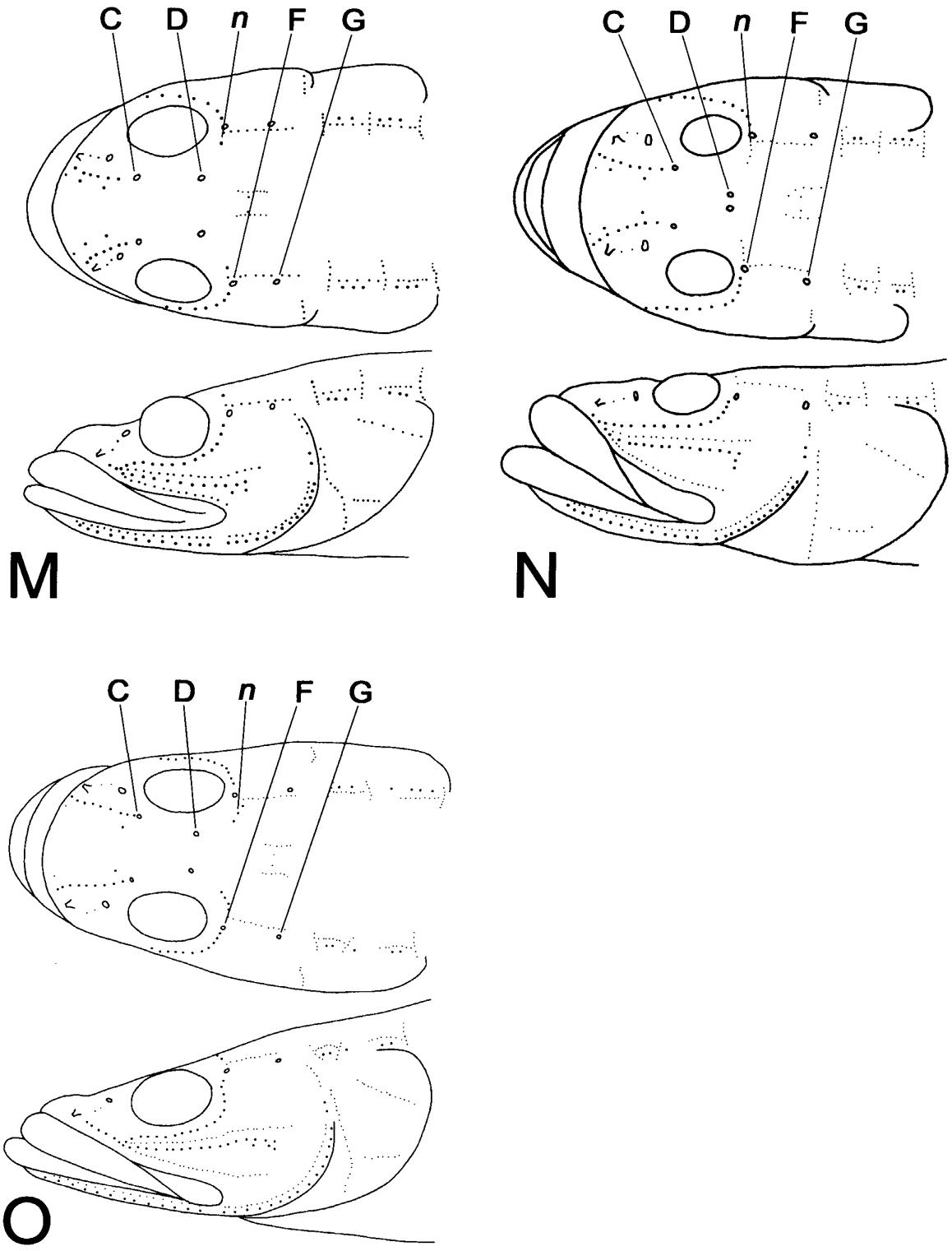

Fig. 4M–O. Dorsal and lateral aspects of head detailing oculoscapular canal pore and sensory papillae morphology. M, *Gymnogobius petschiliensis*, NSMT-P 14396, 60.8 mm SL; N, *G. opperiens* n. sp., NSMT-P 60922, holotype, 67.0 mm SL; O, *G. urotaenia*, UW 027494, 71.0 mm SL. C, anterior interorbital pores; D, paired posterior interorbital pores; F, postorbital pores; G, intermediate otic pores; *n*, anterior transverse row of occipital series of sensory papillae.

oculoscapular canals present (except in *G. castaneus*), not connected by transverse commissure; when present, oculoscapular canals opening through as many as four pairs of pores (C, D, F, and G); gill opening not confined to side of head, but continuing forward below opercle; scales cycloid anteriorly and ctenoid posteriorly, but in some species ctenoid scales very weakly so.

Description. Body elongate, cylindrical anteriorly, becoming compressed posteriorly; anterior scales generally cycloid, in most species becoming increasingly ctenoid on posterior half of body, particularly on caudal peduncle. Genital papilla small and conical; slightly more broad and posteriorly rounded in females than in males, but sexes generally difficult to differentiate when not in spawning condition.

Head narrow to broad, its widest point generally near preopercle; snout rounded in dorsal profile, bluntly pointed or rounded in lateral profile; head without scales. Eyes directed laterally and slightly upward, set anteriorly in head; interorbital space narrow to moderately broad and flat. Anterior nares opening through short, tubular projections; posterior nares flush with snout. Mouth terminal or subterminal, small to large, with maxilla in some species extending posteriorly only to anterior margin or midline of orbit, in other species extending well beyond posterior margin of orbit, usually directed slightly upward; no fleshy flap overlapping middle third of maxilla. Premaxillary and dentary teeth conical, slightly curved, arranged in several irregular rows; canines absent; tongue emarginate. Anterior oculoscapular canals, when present, not connected by commissure; posterior oculoscapular and preopercular canals and pores absent. Sensory papillae pattern variable; three to four longitudinal rows of papillae on cheek, transverse rows absent on cheek (except in *G. uchidai*); interorbital portion of oculoscapular canal replaced by longitudinal row of papillae in some species. Gill opening extending anteriorly below base of pectoral fin; gill membranes attached at isthmus; branchiostegal rays five.

Two dorsal fins separated, not connected by membrane, approximately equal in height. First dorsal fin short, consisting of five to eight spines, anteriormost pterygiophore inserted in fourth (rarely fifth) interneural space; DF highly variable, most commonly beginning 4-122 or 4-121; second dorsal fin consisting of one spine and 9–14 soft rays, posteriormost ray divided to its base, anteriormost pterygiophore inserted in 11th–13th interneural space. Anal fin approximately equal to second dorsal in height, its length shorter than or equal to that of second dorsal, its origin posterior to origin of second dorsal; consisting of one spine and 8–13 soft rays, posteriormost ray divided to its base; two to four anal fin pterygiophores preceding first haemal spine. Caudal fin rounded or truncate, usually consisting of 17 segmented rays (nine dorsal+eight ventral), usually 13 of these being branched (seven dorsal+six ventral), and several dorsal and ventral unsegmented rays; epurals two. Pectoral fins large, rounded, consisting of 16–23 rays; dorsal rays not forming filamentous projections. Pelvic fins elliptical, their length greater than their width, completely fused to each other, consisting of one spine and five soft rays; posterior margin of pelvic frenum slightly concave, with small notch between distal portion of spine and most lateral soft ray on each side (Fig. 2B).

Thirteen species, found in fresh waters, estuarine, and coastal marine waters throughout Japan as well as the Russian Far East and southern Kuril Islands, North and South Korea, and in the Yellow Sea basin of China.

Remarks. As here defined, the genus *Gymnogobius* is the only Asian member of Birdsong *et al.*'s (1988) *Chasmichthys* Group that has separate right and left oculoscapular canals, a characteristic that may represent a developmental truncation from the primitive condition. The North American genus *Eucyclogobius* (another member of the *Chasmichthys* Group) also has separate right and left oculoscapular canals, but the structure of the canals is slightly different from that in *Gymnogobius*, so this condition has likely arisen more than once; therefore, it is possible that *Gymnogobius* is actually paraphyletic. Within the genus there are some distinct species groups (e.g., the *G. castaneus–G. taranetzi–G. breunigii* group), and one or several of these species groups may warrant generic status; however, like the genus itself, the species groups suggested in this study are difficult to define with a convincing synapomorphy, and the relationships among them are far from clear. It is thus premature to consider elevation of the species groups within *Gymnogobius* to generic status. A complete phylogenetic analysis of these species and several outgroups, probably including molecular data, is a necessary step in settling this question. The following 13 species are therefore retained in the genus *Gymnogobius*.

Key to Species of *Gymnogobius*

1. Mouth small; maxilla not extending posteriorly beyond midorbit, and typically not beyond anterior margin of orbit 2
– Mouth moderate to large; maxilla extending posteriorly beyond midorbit, and typically beyond posterior margin of orbit 4
2. Oculoscapular canals and pores present 3
– Oculoscapular canals and pores absent, replaced by rows of sensory papillae in interorbital space (Fig. 4C) ..... *G. castaneus* (p. 272)
3. Oculoscapular canals not extending anteriorly through interorbital space, but replaced by rows of sensory papillae; C pores absent (Fig. 4D) ..... *G. taranetzi* (p. 274)
– Oculoscapular canals extending anteriorly through interorbital space; paired C pores present (Fig. 4E) ..... *G. breunigii* (p. 276)
4. Oculoscapular canals present only in interorbital and postorbital region, opening through paired C, D, and F pores (Fig. 4F–I) 5
– Oculoscapular canals extending posteriorly beyond postorbital region, opening through paired C, D, F, and G pores (Fig. 4J–O) 8
5. Upper jaw extending anteriorly beyond lower jaw; D pores very close together, often joined to form single opening (Fig. 4F, G) 6
– Lower jaw extending anteriorly beyond upper jaw, or jaws approximately equal; D pores close together but distinct, not forming single opening (Fig. 4H, I) 7
6. Patches of pigment restricted to upper 2/3 of body and caudal fin (Fig. 6A, B); anal fin origin posterior to third soft ray of second dorsal fin; second dorsal fin I,11–13; anal fin I,10–11 ..... *G. cylindricus* (p. 280)
– Patches of pigment extending onto lower body and caudal fin, becoming distinct bands below lateral line region (Fig. 6C, D); anal fin origin anterior to third soft ray of second dorsal fin; second dorsal fin I,10–11; anal fin I,8–10 .....

.....*G. scrobiculatus* (p. 281)

7. No fleshy, barbel-like processes behind chin; scales on sides of body loosely arranged, non-imbricate, and easily lost; anterior extent of upper and lower jaws approximately equal.....*G. macrognathos* (p. 285)
– Distinct fleshy, barbel-like processes present behind chin; scales on sides of body imbricate, not easily lost; lower jaw extending anteriorly beyond upper jaw.....*G. uchidai* (p. 287)
8. Head laterally compressed, its depth greater than or equal to its width; spines in first dorsal fin usually seven; second dorsal and anal fins usually I,12; vertebral count greater than 36.....9
– Head broad and depressed, its width greater than its depth; spines in first dorsal fin usually six; second dorsal and anal fins usually I,10 or I,11; vertebral count less than 36.....10
9. Three longitudinal rows of sensory papillae below eye (Fig. 4J); less than 80 scales in longitudinal series; dark blotch on posterior margin of first dorsal fin in females; vertebral count usually 17+21.....*G. heptacanthus* (p. 290)
– Four longitudinal rows of sensory papillae below eye (Fig. 4K); more than 80 scales in longitudinal series; first dorsal fin without dark blotch; vertebral count usually 16+22.....*G. mororanus* (p. 293)
10. Scales extending above insertion of pectoral fin and onto dorsum with fewer than 20 predorsal scales; sensory papillae on cheek oriented in four longitudinal rows.....11
– No scales on dorsum anterior to first dorsal fin or on sides dorsal to insertion of pectoral fin; sensory papillae on cheek oriented in both longitudinal and transverse rows (Fig. 4L).....*G. isaza* (p. 295)
11. First dorsal fin with indistinct bands or without bands, but with dark blotch on posterior margin; two to six sensory papillae in row *n*; second dorsal fin usually I,11; vertebral count usually 15+18 or 16+18.....12
– First dorsal fin with several distinct indented bands, but no dark blotch on posterior margin; one sensory papilla in row *n* (Fig. 4M); second dorsal fin usually I,10; vertebral count usually 15+17.....*G. petschiliensis* (p. 296)
12. Right and left D pores separated by less than one-third orbital diameter (Fig. 4N); dark, y-shaped blotch at base of caudal fin; vertebrae usually 15+18; anal fin usually I,11; first dorsal fin with indistinct oblique, dark bands; anteriormost pterygiophore of first dorsal fin usually inserted in fourth interneural space; anteriormost pterygiophore of second dorsal fin usually inserted in 11th interneural space; in life, white spots on pectoral fin near its insertion.....
.....*G. opperiens* n. sp. (p. 299)
– Right and left D pores separated by more than one-third orbital diameter (Fig. 4O); dark, wedge-shaped blotch at base of caudal fin; vertebrae usually 16+18; anal fin usually I,10; first dorsal fin predominantly dark, with no bands; anteriormost pterygiophore of first dorsal fin commonly inserted in fifth interneural space; anteriormost pterygiophore of second dorsal fin usually inserted in 12th interneural space; in life, no white spots on pectoral fin.....*G. urotaenia* (p. 303)

Gymnogobius castaneus (O'Shaughnessy, 1875), n. comb.
[Japanese name *juzukakehaze*]
(Figs 4C, 5C)

Gobius castaneus O'Shaughnessy, 1875: 145 (type locality: Aomori, Honshu, Japan).
Chloea nakamurae Jordan and Richardson, 1907: 265–266, fig. 3 (type locality: Nagaoka, Echigo, Niigata Prefecture, Japan). **N. syn.**
Chloea senbae Tanaka, 1916: 228 (type locality: Mito, Ibaraki Pref., Japan). **N. syn.**
Chaenogobius annularis annularis: Tomiyama 1936: 90–91 (in part). [Nec Gill, 1859] **N. syn.**
Chaenogobius annularis: Chyung 1954: 380. [Nec Gill, 1859]
Rhodoniichthys laevis: Takagi 1966b: 39, fig. 2B. [Nec Steindachner, 1880]
Chaenogobius laevis: Akihito *et al.* 1984: 276, fig. 174, pl. 252G–J. [Nec Steindachner, 1880]
Gymnogobius laevis: Pietsch *et al.* 2001: 146. [Nec Steindachner, 1880]

Type material. *Gobius castaneus*: BMNH 1870.12.2.1–2, syntypes, 2 (43.5–43.6 mm), Aomori, Honshu, Japan. *Chloea nakamurae*: USNM 61680, paratypes, 2 (32.5–39.2 mm), Nagaoka, Echigo, Niigata Pref., Japan, Nakamura. *Chloea senbae*: ZUMT 57518, syntype, 55.6 mm, Mito, Ibaraki Pref., Japan, Tanaka; ZUMT 57519, syntype, 49.5 mm, Mito, Ibaraki Pref., Japan, Tanaka.

Additional material. BMNH 1903.5.14.58–59, 2 (50.0–51.1 mm), Niigata, Honshu, Japan, Jordan; HUMZ 2537, 61.5 mm, Sapporo, Hokkaido, Japan; HUMZ 2538, 56.7 mm, Sapporo, Hokkaido, Japan; HUMZ 2542, 58.0 mm, Sapporo, Hokkaido, Japan; HUMZ 2543, 58.2 mm, Sapporo, Hokkaido, Japan; HUMZ 2545, 61.8 mm, Sapporo, Hokkaido, Japan; HUMZ 2551, 57.0 mm, Sapporo, Hokkaido, Japan; HUMZ 2552, 61.4 mm, Sapporo, Hokkaido, Japan; HUMZ 2554, 59.2 mm, Sapporo, Hokkaido, Japan; HUMZ 2556, 64.3 mm, Sapporo, Hokkaido, Japan; HUMZ 2558, 66.4 mm, Sapporo, Hokkaido, Japan; HUMZ 2560, 63.8 mm, Sapporo, Hokkaido, Japan; HUMZ 2561, 59.4 mm, Sapporo, Hokkaido, Japan; HUMZ 2563, 56.5 mm, Sapporo, Hokkaido, Japan; HUMZ 2566, 61.0 mm, Sapporo, Hokkaido, Japan; HUMZ 2567, 57.6 mm, Sapporo, Hokkaido, Japan; UW 029184, 5 (37.0–44.0 mm), Zelionyi Island, Kuril Islands, Pietsch; UW 029332, 20 (32.1–45.5 mm), Zelionyi Island, Kuril Islands, Pietsch; UW 040520, 9 (35.0–52.0 mm), Tanfilyeva Island, Kuril Islands, Stevenson; UW 040531, 10 (17.0–27.0 mm), Polonskogo Island, Kuril Islands, Stevenson; UW 044745, 85 (22.0–62.0 mm), Lake Barguzinskoye, southern Sakhalin Island, Russia, Stevenson, Woods, and Reimer; UW 044751, 51.5 mm, Cape Menaputsy, southern Sakhalin Island, Russia, Jensen; UW 044860, 3 (37.1–53.0 mm), Mereya River, southern Sakhalin Island, Russia, Stevenson, Woods, and Reimer.

Diagnosis. Species of *Gymnogobius* unique in lacking oculoscapular canals and pores, these being replaced by rows of sensory papillae. Further characterized by following combination of characters: head broad, its width greater than its depth; one sensory papilla in row *n*; lower jaw extending anteriorly beyond upper; maxilla not extending posteriorly beyond mid-orbit; posterolateral end of mental flap distinct; no fleshy, barbel-like processes behind chin; dark pigment patches on sides forming series of indistinct vertical bands, often extending below level of vertebral column; caudal fin translucent or pale yellow, with dark blotches forming indistinct vertical bands; 0–7 predorsal scales; 60–69 scales in longitudinal series;

modal vertebral count 16+20; first dorsal fin usually with seven spines, anteriormost pterygiophore inserted in fourth interneural space; modal second dorsal fin ray count I,10, anteriormost pterygiophore usually inserted in 12th interneural space; modal anal fin ray count I,10, anal fin origin anterior to third soft ray of second dorsal fin; first dorsal fin with small, dark blotches forming several oblique bands.

Description. Body somewhat elongate, its depth approximately 20% of SL; caudal peduncle moderately deep, its depth approximately 12% of SL. Scales small, ctenoid, covering entire body from base of pectoral fin to caudal fin, on dorsum extending anterior to first dorsal fin in most specimens; head naked; scales in longitudinal series 60–69, scales in transverse series 15–18; predorsal scales 0–7. Several rows of sensory papillae in abdominal region; approximately 30 vertical rows of sensory papillae in *lm* series.

Head somewhat broad, depressed, its width greater than its depth, with broad bulge on snout; eye diameter 20–23% of head length; interorbital space narrow, its width less than orbital diameter; mouth small, directed slightly upward; lower jaw protruding slightly beyond upper jaw; maxilla extending posteriorly to anterior margin of orbit or midorbit; small, conical premaxillary and dentary teeth in four irregular rows; posterolateral end of mental flap distinct, no fleshy, barbel-like processes behind chin; gill rakers short, slender, without tooth patches, 2+9–10 (2+9). Anterior oculoscapular canals and pores absent, each canal replaced by row of sensory papillae (Fig. 4B); four suborbital rows of sensory papillae oriented longitudinally; one sensory papilla in row *n*.

Dorsal fins approximately equal in height and separated, not connected by membrane; first dorsal fin VI–VIII (VII); DF highly variable, modally 4-12120100; second dorsal fin I,9–11 (I,10), anteriormost pterygiophore inserted in 11th–13th (12th) interneural space; anal fin I,8–12 (I,10), its insertion ventral to or anterior to third soft ray of second dorsal; AP 2–4 (3); pectoral fin rounded, not extending to posterior margin of first dorsal fin, pectoral fin rays 19–21 (20); segmented caudal-fin rays 9+8, branched caudal-fin rays 7+6; vertebrae 15–16+18–21 (16+20).

Color in alcohol. Head and body brown, becoming yellowish-white on ventral surface; tiny dark brown or black spots forming irregular blotches on dorsum and usually forming 5–7 broad, irregular, dorsoventrally oriented bands on sides of body, these bands often extending below lateral line region; dark spots generally less dense, and often completely absent, on ventral surface. First and second dorsal fins with several distinct dark, wavy longitudinal bands; first dorsal fin usually with large, dark blotch near posterior margin; anal fin dusky, usually darker near base; caudal fin yellowish and translucent, with distinct dark-brown transverse bands; pectoral fin pale yellow with irregularly placed small, dark-brown spots. Branchiostegal region, pelvic fins, and anal fin black in spawning females.

Distribution. Specimens examined are from southwestern Hokkaido, western Honshu and the northern tip of Honshu, southern Sakhalin Island, and Zelionyi Island, Polonskogo Island, and Tanfilyeva Island in the Kuril Islands. This species has been reported from Hokkaido to Kyushu in Japan (Akihito *et al.* 1984). *Gymnogobius castaneus* usually inhabits freshwater lakes and streams.

Remarks. This species has been widely misunderstood for at least the past 50 years. Takagi (1966b) seems to have been the first to associate the lack of oculoscapular canals and pores with the nominal species *Gobius laevis* Steindachner,

1880, and subsequent authors have followed this alignment; however, the holotype of *Gobius laevis* clearly has oculoscapular canals and four pairs of pores, as well as a broad and depressed head and a jaw that extends posteriorly well beyond the posterior margin of the eye. This specimen certainly does not represent the species that Takagi (1966b) and subsequent authors have identified as "*Chaenogobius laevis*". In fact, *Gobius laevis* is synonymous with *Gobius urotaenia* Hilgendorf, 1879 (see additional remarks under *G. urotaenia*). On the other hand, the two syntypes of *Gobius castaneus* O'Shaughnessy lack oculoscapular canals and have the anterior portion of these canals replaced by rows of sensory papillae (Fig. 4B); therefore, the species that has recently been known as *Chaenogobius laevis* is actually valid as *Gymnogobius castaneus*.

The type locality for this species was reported as Nagasaki, Japan (O'Shaughnessy 1875); however, in the BMNH ledger the locality field for this specimen has "Nagasaki" crossed out and replaced by "Northern part of Japan (Aomori)". The ledger also indicates that this specimen was "purchased of W. Higgins". One possible explanation for this change is that the specimen was purchased in a fish market in Nagasaki, and it was somehow later determined that the origin of the specimen was actually Aomori in northern Japan.

In their study of allozyme polymorphisms, Aizawa *et al.* (1994) found that two populations of *Chaenogobius laevis* (=*Gymnogobius castaneus*), one from northern Honshu and one from central Honshu, did not form a monophyletic unit. This suggests that the specimens herein recognized as *G. castaneus* actually represent two distinct species. While specimens representing the two populations sampled by Aizawa *et al.* (1994) were not examined for this study, the results of Aizawa *et al.* (1994) clearly indicate the need for further detailed study of this species group, including a comparison of extensive series of all three morphological species from throughout their respective ranges.

Comparative remarks. *Gymnogobius castaneus*, *G. taranetzi*, and *G. breunigii* are morphologically similar and form a distinct species group within *Gymnogobius* (hereafter referred to as the *G. castaneus* Group). They share a small mouth and their meristics are virtually identical (Tables 2–4); however, they can be distinguished on the basis of oculoscapular morphology and, to a lesser extent, body coloration. Within this species group, *G. castaneus* has lost the oculoscapular canals and has the most prominent series of vertical bands on the body.

Gymnogobius taranetzi (Pinchuk, 1978), n. comb.
[Japanese name *shinjikohaze*]
(Figs 4D, 5D)

Chloea castanea: Taranetz 1933: 85. [Nec O'Shaughnessy, 1875]
Chaenogobius taranetzi Pinchuk, 1978: 10–11, fig. 3 (type locality: Kedrovka River mouth, Primorski Krai, Russia).
Chaenogobius castaneus: Kim *et al.* 1987: fig. 2h. [Nec O'Shaughnessy, 1875]

Type material. *Chaenogobius taranetzi*: ZISP 42342, holotype, 66.6 mm, Kedrovka River mouth, Primorski Krai, Russia, Pinchuk.

Additional material. LACM 44902-1, 42.5 mm, Shinji Lake, Japan, Hubbs;

LACM 44902-2, 3 (20.0–38.0 mm), Shinji Lake, Japan, Hubbs; UW 044224, 29 (35.2–61.5 mm), Artemovka River, near Vladivostok, Russia, Shedko; HUMZ 43081, 64.0 mm, Chonchin, Kita-chosen, North Korea; ZISP 16967, 5 (39.3–46.1 mm), Tumangan River mouth, Primorski Krai, Russia; ZISP 17479, 6 (37.1–45.8 mm), Lake Kasan, Primorski Krai, Russia; ZISP 25497, 26 (20.2–40.3 mm), Rozanovskoye Lake, Primorski Krai, Russia.

Diagnosis. Species of *Gymnogobius* unique in having only posterior section of interorbital oculoscapular canals, these opening through paired D and F pores. Further characterized by following combination of characters: head broad, its width greater than its depth; right and left D pores distinct; one sensory papilla in row *n*; lower jaw protruding anteriorly beyond upper; maxilla not extending posteriorly beyond mid-orbit; posterolateral end of mental flap distinct; no fleshy, barbel-like processes behind chin; dark pigment patches on sides forming series of indistinct vertical bands, often extending below level of vertebral column; caudal fin translucent, pale yellow, with dark blotches forming indistinct vertical bands; 0–6 predorsal scales; 62–67 scales in longitudinal series; modal vertebral count 16+20; first dorsal fin usually with seven spines, anteriormost pterygiophore inserted in fourth interneural space; modal second dorsal-fin ray count I,10, anteriormost pterygiophore usually inserted in 12th interneural space; modal anal-fin ray count I,10, anal fin origin ventral or anterior to third soft ray of second dorsal fin; first dorsal fin with small, dark blotches forming several oblique bands.

Description. Body somewhat elongate, its depth approximately 20% of SL; caudal peduncle moderately deep, its depth approximately 12% of SL. Scales small, ctenoid, covering entire body from base of pectoral fin to caudal fin, on dorsum extending anterior to first dorsal fin in most specimens; head naked; scales in longitudinal series 62–67, scales in transverse series 17–21; predorsal scales 0–6. Several rows of sensory papillae in abdominal region; approximately 30 vertical rows of sensory papillae in *lm* series.

Head somewhat broad, depressed, its width greater than its depth, with broad bulge on snout; eye diameter 18–22% of head length; interorbital space narrow, its width less than orbital diameter; mouth small, directed slightly upward; lower jaw protruding slightly beyond upper jaw; maxilla extending posteriorly to anterior margin of orbit or midorbit; small, conical premaxillary and dentary teeth in four irregular rows; posterolateral end of mental flap distinct; no fleshy, barbel-like processes behind chin; gill rakers short, slender, without tooth patches, 2–3+10–11 (2+10). Anterior oculoscapular canals restricted to posterior interorbital and postorbital region, opening through paired D and F pores, anterior interorbital portion of each canal replaced by row of sensory papillae (Fig. 4C); four suborbital rows of sensory papillae oriented longitudinally; one sensory papilla in row *n*, directly dorsomedial to F pore.

Dorsal fins approximately equal in height and separated, not connected by membrane; first dorsal fin VII–VIII (VII); DF highly variable, modally 4-12121000; second dorsal fin I,10–11 (I,10), anteriormost pterygiophore inserted in 11th–13th (12th) interneural space; anal fin I,9–11 (I,10), its origin ventral or anterior to third soft ray of second dorsal; AP 2–3 (3); pectoral fin rounded, not extending to posterior margin of first dorsal fin, pectoral fin rays 19–21 (20); segmented caudal-fin rays 9+8, branched caudal-fin rays 7+6; vertebrae 15–16+19–21 (16+20).

Color in alcohol. Head and body brown, becoming yellowish-white on ventral

surface; tiny dark brown or black spots forming indistinct vermiculations on dorsum, series of dark blotches in lateral line region, and often 5–7 obscure, broad, dorsoventrally oriented bands on sides of body, these last often extending below lateral line region; dark spots generally less dense, and often completely absent, on ventral surface. First and second dorsal fins with several distinct dark, wavy longitudinal bands; first dorsal fin usually with large, dark blotch near posterior margin; anal fin dusky, usually darker near base; caudal fin yellowish and translucent, with distinct dark-brown transverse bands; pectoral fin pale yellow with irregularly placed small, dark-brown spots. Branchiostegal region, pelvic fins, and anal fin black in spawning females.

Distribution. Specimens examined are from Shinji Lake in Japan, the southern part of the Maritime Territory (Primorski Krai) of the Russian Far East, and eastern North Korea. *Gymnogobius taranetzi* is a widely euryhaline species that has been collected in freshwater, brackish water, and fully marine habitats.

Remarks. The distinguishing characteristic of this species, which is the configuration of the oculoscapular canals, was noted by Russian authors 45 years before the species was described. Taranetz (1933) was the first to note this canal configuration, but he identified his material as *Chloea castanea* and used the truncated oculoscapular canal pattern to define the genus *Chloea*, stating, "The genus *Chloea* differs from *Gymnogobius* in the structure of the mucous canals on the upper part of the head" (p. 85). The genus remained thus defined by Russian authors for over four decades. When Pinchuk (1978) synonymized *Chloea* with *Chaenogobius*, he recognized *Chaenogobius castaneus*, with paired anterior interorbital, posterior interorbital, and postorbital pores, in agreement with Takagi (1966b). However, he also recognized that the species that Russian authors since Taranetz (1933) had been calling *C. castaneus*, with truncated oculoscapular canals and only two pairs of pores, was really a separate, undescribed species. He described this species as *Chaenogobius taranetzi*, based on specimens from the southern Primorski Krai in Russia. Japanese authors (Koshikawa and Sato 1986) later discovered this same species in Lake Shinji in Japan, but they were unable to determine its conspecificity. This investigation confirms that the species inhabiting Lake Shinji is indeed *Gymnogobius taranetzi*.

Comparative remarks. Within the *G. castaneus* Group, *G. taranetzi* is intermediate between the other two species. It has a more reduced oculoscapular canal pattern than *G. breunigii*, but the canals are not absent, as in *G. castaneus*. It also has dark vertical bands on the body, as in *G. castaneus*, but they are not as prominent.

Gymnogobius breunigii (Steindachner, 1880), n. comb.
[Japanese name *biringo*]
(Figs 4E, 5E)

Gobius breunigii Steindachner, 1880: 138–140 (type locality: Hakodate, Japan).
Aboma breunigi: Jordan and Snyder 1901b: 71.
Chloea castanea: Jordan and Snyder 1901b: 79–80. [Nec O'Shaughnessy, 1875]
Chloea castanaea [sic]: Jordan and Hubbs 1925: 307–308. [Nec O'Shaughnessy, 1875]
Chaenogobius annularis annularis: Tomiyama 1936: 90–91 (in part). [Nec Gill, 1859]
N. syn.

Chaenogobius castanea: Matsubara 1955: 838. [Nec O'Shaughnessy, 1875]
Chaenogobius annularis: Fowler 1961: 62–63 (in part). [Nec Gill, 1859]
Chaenogobius castaneus: Takagi 1966b: figs 1, 2A. [Nec O'Shaughnessy, 1875]
Gymnogobius castaneus: Pietsch *et al.* 2001: 145. [Nec O'Shaughnessy, 1875]

Type material. *Gobius breunigii*: NMW 30276, syntypes, 7 (31.2–47.8 mm), Hakodate, Japan.

Additional material. BMNH 1907.12.23.271, 41.2 mm, Toshi Island, Japan, Smith; HUMZ 43250, 51.5 mm, Usu, Hokkaido, Japan; HUMZ 67073, 38.5 mm, Moheji, Hokkaido, Japan; HUMZ 68919, 34.5 mm, Daitobetsu, Hakodate Bay, Hokkaido, Japan; HUMZ 154943, 43.3 mm, Kattoshi, Kamiiso, Hokkaido, Japan; HUMZ 154944, 42.5 mm, Kattoshi, Kamiiso, Hokkaido, Japan; HUMZ 154945, 40.0 mm, Kattoshi, Kamiiso, Hokkaido, Japan; HUMZ 154946, 39.2 mm, Kattoshi, Kamiiso, Hokkaido, Japan; HUMZ 154947, 38.0 mm, Kattoshi, Kamiiso, Hokkaido, Japan; HUMZ 154948, 36.4 mm, Kattoshi, Kamiiso, Hokkaido, Japan; HUMZ 154949, 36.0 mm, Kattoshi, Kamiiso, Hokkaido, Japan; HUMZ 154950, 37.9 mm, Kattoshi, Kamiiso, Hokkaido, Japan; HUMZ 154951, 37.4 mm, Kattoshi, Kamiiso, Hokkaido, Japan; HUMZ 154952, 37.4 mm, Kattoshi, Kamiiso, Hokkaido, Japan; UW 029160, 15 (41.5–54.5 mm), Iturup Island, Kuril Islands, Pietsch; UW 029163, 15 (31.0–49.0 mm), Iturup Island, Kuril Islands, Pietsch; UW 029281, 5 (40.0–45.0 mm), Kunashir Island, Kuril Islands, Pietsch; UW 040527, 21 (41.0–56.0 mm), Shikotan Island, Kuril Islands, Stevenson; UW 044782, 46.5 mm, Lake Dolgoye, southern Sakhalin Island, Russia, Stevenson, Woods, and Reimer; ZISP 40942, 28.2 mm, Shikotan Island, Kuril Islands, Turyanova.

Diagnosis. Species of *Gymnogobius* characterized by following combination of characters: head broad, its width greater than its depth; anterior oculoscapular canals extending only to postorbital region, opening through paired C, D, and F pores; right and left D pores distinct; one sensory papilla in row *n*; lower jaw protruding anteriorly beyond upper; maxilla not extending posteriorly beyond mid-orbit; posterolateral end of mental flap distinct; no fleshy, barbel-like processes behind chin; dark pigment patches forming reticulations on head, dorsum, and sides, extending below level of vertebral column but usually not onto belly; caudal fin translucent, pale yellow, with dark blotches forming indistinct vertical bands; 3–8 predorsal scales; 60–71 scales in longitudinal series; modal vertebral count 16+20; first dorsal fin with seven spines, anteriormost pterygiophore inserted in fourth interneural space; modal second dorsal fin ray count I,10, anteriormost pterygiophore usually inserted in 12th interneural space; modal anal fin ray count I,10, anal fin origin ventral or anterior to third soft ray of second dorsal fin; first dorsal fin with small, dark blotches forming several oblique bands.

Description. Body somewhat elongate, its depth approximately 20% of SL; caudal peduncle moderately deep, its depth approximately 12% of SL. Scales small, ctenoid, covering entire body from base of pectoral fin to caudal fin, on dorsum extending anterior to first dorsal fin in many specimens; head, cheek, and opercle naked; scales in longitudinal series 60–71, scales in transverse series 16–19; predorsal scales 3–8. Several rows of sensory papillae in abdominal region; 29–31 vertical rows of sensory papillae in *lm* series.

Head somewhat broad, depressed, its width greater than its depth, with broad bulge on snout; eye diameter 20–25% of head length; interorbital space narrow, its

width less than orbital diameter; mouth small, directed slightly upward; lower jaw protruding slightly beyond upper jaw; maxilla extending posteriorly to anterior margin of orbit or midorbit; small, conical premaxillary and dentary teeth in four irregular rows; posterolateral end of mental flap distinct; no fleshy, barbel-like processes behind chin; gill rakers short, slender, without tooth patches, 2–3+9–11 (2+10). Anterior oculoscapular canals opening through paired C, D, and F pores (Fig. 4D); four suborbital rows of sensory papillae oriented longitudinally; one sensory papilla in row *n*, directly dorsomedial to F pore.

Dorsal fins approximately equal in height and separated, not connected by membrane; first dorsal fin VII–VIII (VII); DF highly variable, modally 4-12121000; second dorsal fin I,9–11 (I,10), anteriormost pterygiophore inserted in 11th–13th (12th) interneural space; anal fin I,9–11 (I,10), its origin ventral or anterior to third soft ray of second dorsal fin; AP 2–4 (4); pectoral fin rounded, not extending to posterior margin of first dorsal fin, pectoral fin rays 18–21 (20); segmented caudal-fin rays 9+7–8 (9+8), branched caudal-fin rays 7+6; vertebrae 15–16+19–21 (16+20).

Color in alcohol. Head and body brown, becoming yellowish-white on ventral surface; tiny dark brown or black spots forming indistinct vermiculations on dorsum and on sides down to lateral line region; dorsoventrally oriented bands absent; dark spots generally less dense, and often completely absent, on ventral surface. First and second dorsal fins with several distinct dark, wavy longitudinal bands; first dorsal fin usually with large, dark blotch near posterior margin; anal fin dusky, usually darker near base; caudal fin yellowish and translucent, with distinct dark-brown transverse bands; pectoral fin pale yellow with irregularly placed small, dark-brown spots. Branchiostegal region, pelvic fins, and anal fin black in spawning females.

Distribution. Specimens examined are from southern Hokkaido, southern Sakhalin Island, and the islands of Shikotan, Iturup, and Kunashir in the Kuril Islands. This species has been reported from Hokkaido to Yakushima in Japan (Akihito *et al.* 1984) and from the southern and eastern coasts of South Korea and Quelpart (i.e. Cheju) Island (Kim *et al.* 1987; Choi *et al.* 1990). *Gymnogobius breunigii* inhabits brackish water and freshwater lakes and streams.

Remarks. This species has been incorrectly recognized as *Gymnogobius castaneus* by a number of authors, including all those treating this group in the last 30 years; however, neither of the syntypes of *Gobius castaneus* O'Shaughnessy has any oculoscapular canals or any remnants of canals, so that name cannot be applied to this species. The nominal species *Gobius breunigii* Steindachner has been placed in *Aboma* (Jordan and Snyder 1901b; Jordan *et al.* 1913), considered a junior synonym of *Chaenogobius annularis* (Tomiyama 1936; Okada 1961; Chyung 1977), or completely ignored (Berg 1949; Lindberg and Krasyukova 1975; Pinchuk 1978, 1984). The syntypes of *G. breunigii* clearly have the small mouth characteristic of the *G. castaneus* group and all seven specimens have paired C, D, and F pores; therefore, they do represent the present species, which is thus valid as *Gymnogobius breunigii*.

Comparative remarks. Within the *G. castaneus* group, *G. breunigii* has the most extensive oculoscapular canal pattern, with three pairs of pores. This species is also the only one in the group whose body coloration is dominated by dark vermiculations on the dorsal surface, with only indistinct dark, vertical bands, if any at all.

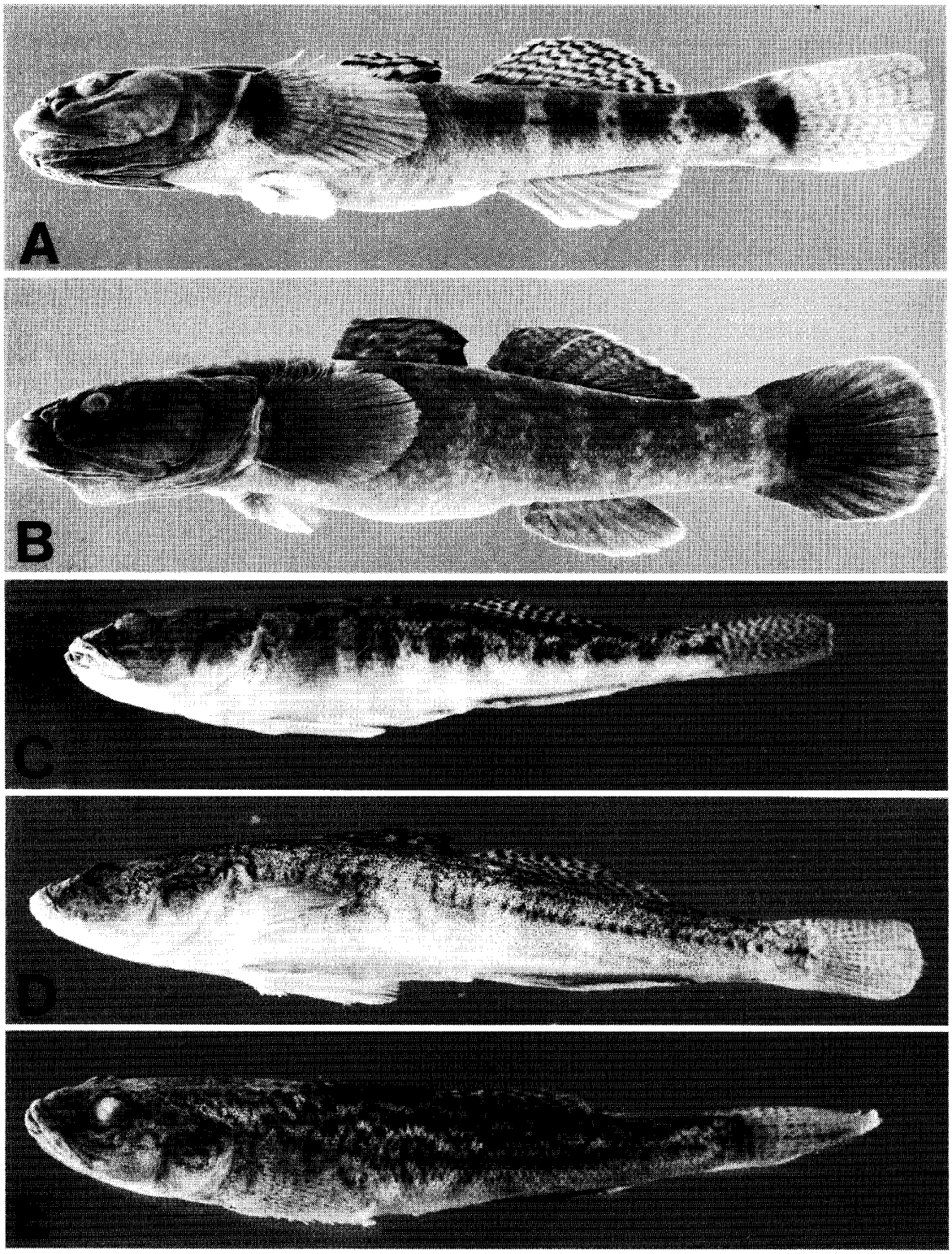

Fig. 5. Photographs of gobies. A, *Chaenogobius annularis*, HUMZ 109687, 102.9 mm SL; B, *C. gulosus*, HUMZ 154885, 51.8 mm SL; C, *Gymnogobius castaneus*, UW 040521, 51.3 mm SL; D, *G. taranetzi*, UW 044224, 61.5 mm SL; E, *G. breunigii*, UW 040527, 56.1 mm SL. Photos by P. McGiffert.

Gymnogobius cylindricus (Tomiyama, 1936), n. comb.
[Japanese name *kiseruhaze*]
(Figs 4F, 6A, B)

Chaenogobius cylindricus Tomiyama, 1936: 92, fig. 39 (type locality: Hiroshima, Japan).

Type material. *Chaenogobius cylindricus*: ZUMT 30386, holotype, 44.0 mm, Hiroshima, Japan, Shiga Fisheries Station.

Additional material. BLIH 1993001, 49.2 mm, Chigusa River, Ako, Honshu, Japan, Suzuki; BLIH 1993284, 2 (50.0–52.0 mm), Chigusa River, Ako, Honshu, Japan, Suzuki.

Diagnosis. Species of *Gymnogobius* characterized by following combination of characters: head somewhat broad, its width approximately equal to its depth; anterior oculoscapular canals extending only to postorbital region, opening through paired C, D, and F pores; right and left D pores adjacent to each other or fused to form single opening; one sensory papilla in row *n*; upper jaw protruding anteriorly beyond lower; maxilla extending posteriorly beyond posterior margin of eye and beyond margin of gape; posterolateral end of mental flap distinct; no fleshy, barbel-like processes behind chin; dark pigment patches on side forming vertical bands extending to lateral line region, but not onto belly; caudal fin translucent, pale yellow, with dark blotches forming distinct bands on upper and middle rays; predorsal scales absent; longitudinal series scale count approximately 50–60; vertebral count 15+18; first dorsal fin with six spines, anteriormost pterygiophore inserted in fourth interneural space; modal second dorsal fin ray count I,13, anteriormost pterygiophore usually inserted in 11th interneural space; modal anal fin ray count I,10, anal fin origin posterior to third soft ray of second dorsal fin; first dorsal fin with small, dark blotches forming several oblique bands.

Description. Body elongate, its depth approximately 12% of SL; caudal peduncle slender, its depth approximately 8% of SL. Scales small, ctenoid, covering entire body from base of pectoral fin to caudal fin, but absent on dorsum anterior to second dorsal fin and on sides dorsal to pectoral fin base; head naked; scales in longitudinal series approximately 50–60, scales in transverse series approximately 10–12. Several rows of sensory papillae in abdominal region; *lm* series of sensory papillae obscure.

Head cylindrical, its width approximately equal to its depth, with broad, low bulge on snout; eye diameter approximately 20% of head length; interorbital space narrow, its width less than orbital diameter; mouth large, directed slightly upward; upper jaw protruding slightly beyond lower jaw; maxilla extending posteriorly beyond posterior margin of orbit and beyond perimeter of gape, its posterior end not attached to cheek; small, conical premaxillary and dentary teeth in four irregular rows; posterolateral end of mental flap distinct; no fleshy, barbel-like processes behind chin; gill rakers short, slender, without tooth patches, count unknown. Anterior oculoscapular canals opening through paired C, D, and F pores (Fig. 4E); right and left D pores very close together, fused to create single pore in some specimens; four suborbital rows of sensory papillae oriented longitudinally; one sensory papilla in row *n*, posteromedial to F pore.

Dorsal fins approximately equal in height and separated, not connected by

membrane; first dorsal fin VI; DF modally 4-1220100; second dorsal fin I,11–13 (I,13), anteriormost pterygiophore inserted in 11th or 12th (11th) interneural space; anal fin I,10–11 (I,10), its origin posterior to third soft ray of second dorsal; AP 2; pectoral fin rounded, not extending to posterior margin of first dorsal fin, pectoral fin rays 16–18 (18); segmented caudal-fin rays 9+8, branched caudal-fin rays 7+6; vertebrae 15+18.

Color in alcohol. Head and body brown, becoming yellowish-white on ventral surface; tiny dark brown or black spots forming distinct, dorsoventrally oriented bands on sides down to lateral line region; dark spots generally less dense, and often completely absent, on ventral surface. First and second dorsal fin with translucent membranes and pigment concentrated along spines and rays forming several distinct, dark longitudinal bands; first dorsal fin with indistinct dark blotch near posterior margin; anal fin dusky; caudal fin slightly yellowish, with translucent membrane and distinct, dark-brown transverse bands on upper and middle rays; pectoral fin pale yellow with irregularly placed small, dark-brown spots. In life, ventral surface of body white to bright yellow; lower opercula silvery.

Distribution. Specimens examined are from southern Honshu in the Seto Inland Sea. Akihito *et al.* (1984) reported this species from Shikoku, Tsushima, the Goto Islands, and Kyushu; however, at least some of their records, and perhaps all of them, are misidentified specimens of *G. scrobiculatus*. Pinchuk (1978) and Sheiko (1983) reported this species from Peter the Great Bay, but the single specimen that Pinchuk examined (ZISP 9599) is no longer in the ZISP collection, nor is any other specimen of this species. *Gymnogobius cylindricus* inhabits shallow marine waters.

Remarks. This species has commonly been confused with *Gymnogobius scrobiculatus*. In fact, Akihito *et al.* (1984) considered *G. cylindricus* and *G. scrobiculatus* to be synonymous (see below). However, as Suzuki and Masuda (1993) pointed out, these two species can clearly be distinguished based on color pattern, anal fin insertion, and meristics. Tomiyama's (1936: 92, fig. 39) illustration accurately depicts these characteristics in *G. cylindricus* with the exception of the coloration of the caudal fin. The photographs of Suzuki and Masuda (1993, figs 1–8) clearly illustrate the color differences between *G. cylindricus* and *G. scrobiculatus* (see Fig. 6A, B).

Comparative remarks. *Gymnogobius cylindricus* is very similar to *G. scrobiculatus*, but can be distinguished from the latter by the lack of dark pigment patches on the lower body and lower part of the caudal fin. In addition, the anal fin origin of *G. cylindricus* is more posterior than that of *G. scrobiculatus* and the second dorsal-fin ray and anal-fin ray counts are higher.

Gymnogobius scrobiculatus (Takagi, 1957), n. comb.
[Japanese name *kubohaze*]
(Figs 4G, 6C, D)

Chaenogobius scrobiculatus Takagi, 1957: 120–123, fig. 7 (type locality: Muromi R., Fukuoka, Japan).

Chaenogobius cylindricus: Akihito *et al.* 1984: 277–278, pl. 253-A. [Nec Tomiyama, 1936]

Type material. Type material apparently lost; not present in BLIH collection (see Remarks). Neotype hereby designated OMNH-P 11261, 29.9 mm, mouth of Asa River, Ushirogata-kami, Nishi-Takadomari, Onoda, Yamaguchi Prefecture, Honshu, Japan.

Additional material. BLIH 19891183, 5 (28.6–33.8 mm), Hake River, Ohmishima Island, Ehime Prefecture, Japan; BLIH 1990103, 2 (29.8–30.4 mm), Shimanto River, Nakamura, Kochi Prefecture, Shikoku, Japan, Kinoshita; BLIH 1990104, 3 (28.2–33.4 mm), Shimanto River, Nakamura, Kochi Prefecture, Shikoku, Japan, Kinoshita; OMNH-P 11262, 24.0 mm, collected with neotype; OMNH-P 13484, 27.3 mm, mouth of Imadu River, Aihara, Yamaguchi City, Yamaguchi Prefecture, Honshu, Japan.

Diagnosis. Species of *Gymnogobius* unique in having five or six dark, narrow, vertical bands extending onto belly. Further characterized by following combination of characters: head somewhat broad, its width approximately equal to its depth; anterior oculoscapular canals extending only to postorbital region, opening through paired C, D, and F pores; right and left D pores adjacent to each other or fused to form single opening; one sensory papilla in row *n*; upper jaw protruding anteriorly beyond lower; maxilla extending posteriorly beyond posterior margin of eye and beyond margin of gape; posterolateral end of mental flap distinct; no fleshy, barbel-like processes behind chin; caudal fin translucent, pale yellow, with dark blotches forming distinct bands on all rays; predorsal scales absent; longitudinal series scale count approximately 50–60; modal vertebral count 15+18; first dorsal fin with six spines, anteriormost pterygiophore inserted in fourth interneural space; modal second dorsal-fin ray count I,10, anteriormost pterygiophore usually inserted in 12th interneural space; modal anal-fin ray count I,9, anal fin origin anterior to third soft ray of second dorsal fin; first dorsal fin with small, dark blotches forming several oblique bands.

Description. Body elongate, its depth approximately 13% of SL; caudal peduncle slender, its depth approximately 8% of SL. Scales small, ctenoid, embedded, covering entire body from base of pectoral fin to caudal fin, but absent on dorsum anterior to second dorsal fin and on sides dorsal to pectoral fin base; head naked; scales in longitudinal series approximately 50–60, scales in transverse series approximately 10–12. Several rows of sensory papillae in abdominal region; *lm* series of sensory papillae obscure.

Head cylindrical, its width approximately equal to its depth, with broad, low bulge on snout; eye diameter approximately 20% of head length; interorbital space narrow, its width less than orbital diameter; mouth large, directed slightly upward; upper jaw protruding slightly beyond lower jaw; maxilla extending beyond posterior margin of orbit and beyond perimeter of gape, its posterior end not attached to cheek; small, conical premaxillary and dentary teeth in four irregular rows; posterolateral end of mental flap distinct; no fleshy, barbel-like processes behind chin; gill rakers short, slender, without tooth patches, 3+8. Anterior oculoscapular canals opening through paired C, D, and F pores (Fig. 4E); right and left D pores very close together, fused to create single opening in some specimens; four suborbital rows of sensory papillae oriented longitudinally; one sensory papilla in row *n*, posteromedial to F pore.

Dorsal fins approximately equal in height and separated, not connected by membrane; first dorsal fin VI; DF modally **4-12111000**; second dorsal fin **I,10**–11 (I,10), anteriormost pterygiophore inserted in 12th interneural space; anal fin

I,8–**9**–10 (I,9), its origin ventral or anterior to third soft ray of second dorsal; AP **2**–3 (2); pectoral fin rounded, not extending to posterior margin of first dorsal fin, pectoral fin rays 17–**18** (18); segmented caudal-fin rays 9+8, branched caudal-fin rays 7 +6; vertebrae 15+18.

Color in alcohol. Head and body brown, becoming yellowish-white on ventral surface; tiny dark brown or black spots forming distinct, narrow, dorsoventrally oriented bands on sides down to lateral line region, extending onto belly as 5–6 distinct bands; dark spots generally less dense, and often completely absent, on ventral surface. First and second dorsal fins with translucent membranes and pigment concentrated along spines and rays forming several distinct dark longitudinal bands; first dorsal fin with vague dark blotch near posterior margin; anal fin dusky; caudal fin slightly yellowish, with translucent membrane and distinct dark-brown transverse bands on all rays; pectoral fin pale yellow with irregularly placed small, dark-brown spots. In life, ventral surface of body white to bright yellow, especially in spawning females, and lower opercula silvery white.

Distribution. Specimens examined are from western Shikoku and southwestern Honshu, and the type locality is on northern Kyushu. Suzuki and Masuda (1993) reported this species from southern Honshu, Shikoku, Kyushu, and Tsushima Island in Japan. *Gymnogobius scrobiculatus* inhabits shallow marine and brackish waters.

Remarks. In the original description of this species, Takagi (1957) stated that it differs from *Gymnogobius cylindricus* in that the scales are ctenoid and the maxilla is longer. Akihito *et al.* (1984) believed these differences were attributable to the difference in size between the type specimens of the two species, and therefore synonymized the two, while Pinchuk (1984) continued to recognize both species. Tomiyama (1936) incorrectly believed the scales of *G. cylindricus* to be cycloid, as they are indeed finely ctenoid, but his scale counts could not be reliably verified with the specimens examined in this study. Suzuki and Masuda (1993) recognized differences in color pattern and anal fin placement in the two species, providing excellent photos of each. Both of these species are poorly represented in collections, but clearly differences exist.

Takagi (1957) described this species as *Chaenogobius scrobiculatus* based on five specimens, which he transferred to the Imperial Household upon retirement (K. Takagi, pers. comm., 24 February 2000). However, these specimens appear to actually be lost; only a few small pieces of broken bone remain in a completely dried up bottle with a label "No. 2". These pieces may be the fragments of a paratype, and the holotype is believed to be lost. There is some question as to whether Takagi (1957) was actually just re-describing *G. cylindricus*, since the characteristics that he used to differentiate *G. scrobiculatus* do not clearly distinguish them; however, the second-dorsal and anal-fin ray counts published in the description of the latter are below the range of *G. cylindricus*, so synonymy between the two nominal species is unlikely. Due to the similarity of these two species and the taxonomic confusion surrounding their identity, a neotype is herein chosen for *Chaenogobius scrobiculatus*. The neotype specimen was collected on 24 May 1998 by A. Notomo at the mouth of the Asa River, Ushirogata-kami, Nishi-Takadomari, Onoda, in Yamaguchi Prefecture, Honshu, Japan, along with one other specimen (OMNH-P 11262). The neotype locality is in the prefecture adjacent to Fukuoka Prefecture, where the original type specimen was collected, though on a different island.

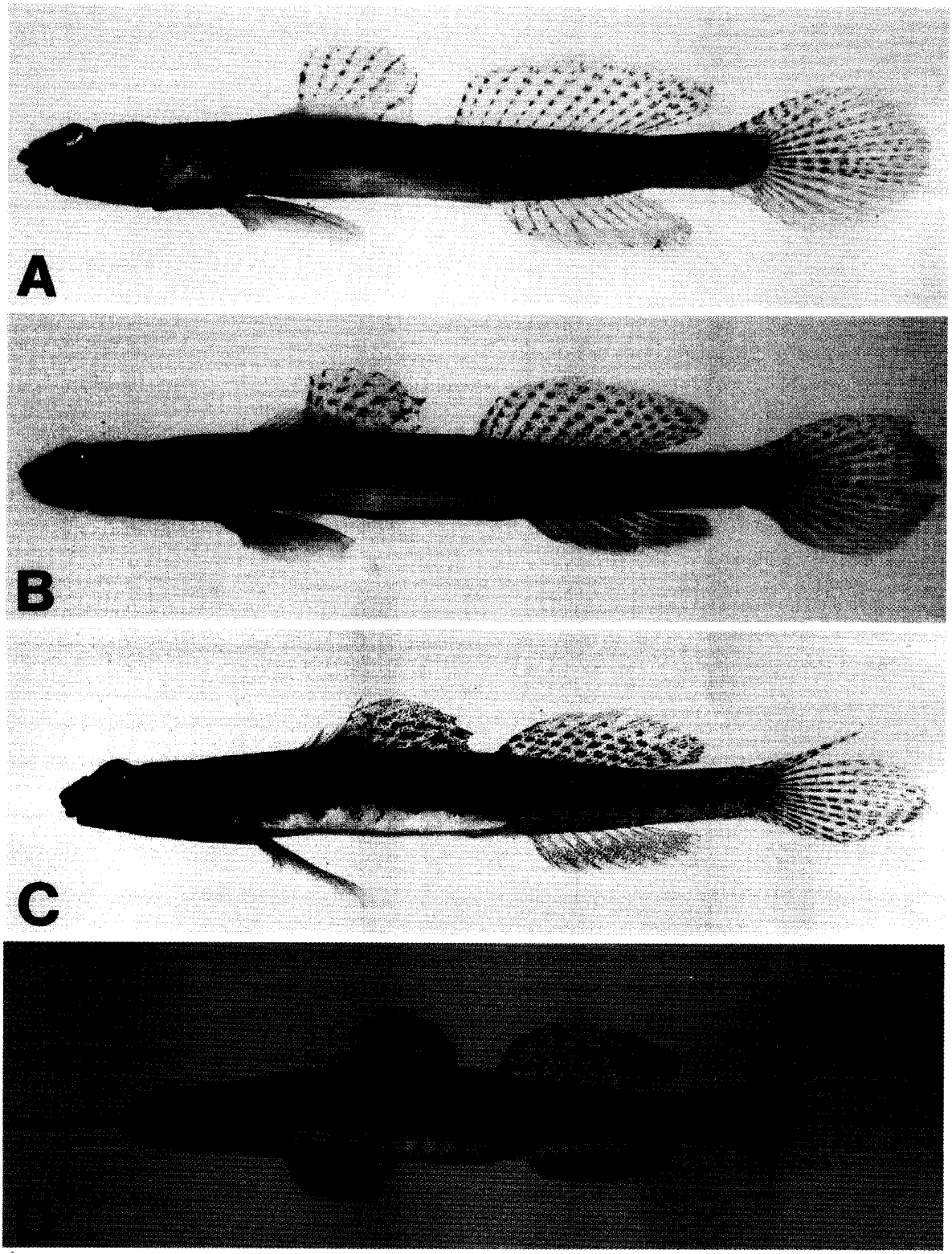

Fig. 6. Photographs of gobies. A, *Gymnogobius cylindricus*, male, BLIH 1993001, 49.2 mm SL; B, *G. cylindricus*, female, OMNH-P 3006, 54.1 mm SL; C, *G. scrobiculatus*, male, OMNH-P 11261, neotype, 29.9 mm SL; D, *G. scrobiculatus*, female, BLIH 1990104-1. Photos by T. Suzuki (A, B), M. Hatooka (C), and Y. Ikeda (D).

Comparative remarks. *Gymnogobius scrobiculatus* can be distinguished from *G. cylindricus* by the presence of dark pigment patches on the lower body and lower part of the caudal fin. In addition, the anal fin origin of *G. scrobiculatus* is more anterior than that of *G. cylindricus* and the second dorsal-fin ray and anal-fin ray counts are lower.

Gymnogobius macrognathos (Bleeker, 1860)
[Japanese name *edohaze*]
(Figs 4H, 7A, B)

Gobius macrognathos Bleeker, 1860: 83–84, tab. II, fig. 1 (type locality: Jeddo).
Gobiosoma macrognathos: Günther 1861: 86.
Gymnogobius macrognathus [sic]: Gill 1863: 269.
Gymnogobius raninus Taranetz, 1934: 398 (type locality: Peter the Great Bay, Russia). [Synonymized by Pinchuk (1978)]
Chaenogobius macrognathus [sic]: Tomiyama 1936: 89–90, fig. 37.
Chaenogobius macrognathos: Pinchuk 1978: 9.
Gymnogobius macrognathos: Pietsch *et al.* 2001: 146.

Type material. *Gobius macrognathos*: RMNH 4461, holotype, 35.5 mm, Jeddo. *Gymnogobius raninus*: ZISP 25485, lectotype, 29.7 mm, Shiauodem River mouth, Peter the Great Bay, Russia, Taranetz; ZISP 35325, paralectotype, 26.5 mm, Olga Bay, Primorski Krai, Russia, Tarasov.

Additional material. NSMT-P 35574, 4 (18.8–29.5 mm), Yoshino River, Shikoku, Japan, Sato and Aizawa; NSMT-SK 4947, 3 (30.2–31.0 mm), Tone River, Ibaraki Prefecture, Honshu, Japan, Nakamura; NSMT-SK 5002, 2 (26.0–28.3 mm), Tone River, Ibaraki Prefecture, Honshu, Japan, Nakamura; NSMT-SK 6490, 16 (25.5–37.0 mm), Tone River, Ibaraki Prefecture, Honshu, Japan, Nakamura; ZISP 36409, 3 (33.7–37.0 mm), Tsingtao, Yellow Sea, China, Turyanova.

Diagnosis. Species of *Gymnogobius* unique in having anterior extent of upper and lower jaws approximately equal and in having loosely placed, non-imbricate scales. Further characterized by following combination of characters: head somewhat broad, its width approximately equal to its depth; anterior oculoscapular canals extending only to postorbital region, opening through paired C, D, and F pores; right and left D pores distinct; one sensory papilla in row *n*; maxilla extending posteriorly beyond posterior margin of eye and beyond margin of gape; posterolateral end of mental flap indistinct, continuous posteriorly; no fleshy, barbel-like processes behind chin; dark pigment patches on side forming vertical bands extending to lateral line region but not onto belly; caudal fin translucent, pale yellow, with dark blotches forming distinct bands on upper and middle rays; predorsal scales absent; scales on side of body loosely arranged and easily lost, approximately 45–50 in longitudinal series; modal vertebral count 16+19; first dorsal fin with six spines, anteriormost pterygiophore inserted in fourth interneural space; modal second dorsal-fin ray count I,11, anteriormost pterygiophore usually inserted in 12th interneural space; modal anal-fin ray count I,10, anal fin origin posterior to third soft ray of second dorsal fin; first dorsal fin with small, dark blotches forming several oblique bands.

Description. Body elongate, its depth approximately 14% of SL; caudal peduncle slender, its depth 7–8% of SL. Scales small, ctenoid, sparsely placed, not overlapping, easily lost, covering entire body from base of pectoral fin to caudal fin but absent on dorsum anterior to second dorsal fin and on sides dorsal to pectoral fin base; head naked; scales in longitudinal series approximately 45–50, scales in transverse series approximately 10. Several rows of sensory papillae in abdominal region; *lm* series of sensory papillae obscure.

Head cylindrical, its width approximately equal to its depth, with broad, low bulge on snout; eye diameter approximately 25% of head length; interorbital space narrow, its width less than orbital diameter; mouth large, directed slightly upward; upper and lower jaws approximately equal in anterior extent; maxilla extending posteriorly beyond posterior margin of orbit and beyond perimeter of gape, its posterior end not attached to cheek; small, conical premaxillary and dentary teeth in four irregular rows; posterolateral end of mental flap indistinct, continuous posteriorly; no fleshy, barbel-like processes behind chin; gill rakers short, slender, without tooth patches, 2+8. Anterior oculoscapular canals opening through paired C, D, and F pores (Fig. 4F); right and left D pores well separated; four suborbital rows of sensory papillae oriented longitudinally; one sensory papilla in row *n*, posteromedial to F pore.

Dorsal fins separated, not connected by membrane, first somewhat higher than second in females, equal in males; first dorsal fin V–VII (VI); DF highly variable, modally 4-12201000; second dorsal fin I,10–12 (I,11), anteriormost pterygiophore inserted in 11th–13th (12th) interneural space; anal fin I,9–11 (I,10), its origin ventral or posterior to third soft ray of second dorsal fin; AP 2–3 (2); pectoral fin rounded, not extending to posterior margin of first dorsal fin, pectoral fin rays 20; segmented caudal-fin rays 9+8, branched caudal-fin rays 7+6; vertebrae 16+18–20 (16+19).

Color in alcohol. Head and body brown, becoming yellowish-white on ventral surface; tiny dark brown or black spots forming distinct, narrow, dorsoventrally oriented bands on sides down to lateral line region; dark spots generally less dense, and often completely absent, on ventral surface. First and second dorsal fins with several distinct dark longitudinal bands; first dorsal fin with vague dark blotch near posterior margin; anal fin dusky; caudal fin translucent, slightly yellow with distinct dark-brown transverse bands on upper and middle rays; pectoral fin pale yellow with irregularly placed small, dark-brown spots. In life, abdominal area, prepectoral area, and lower opercula white.

Distribution. Specimens examined are from the Pacific side of central Honshu and eastern Shikoku in Japan, the southern Maritime Territory in Russia, and the Chinese coast along the Shandong Peninsula in the Yellow Sea. Akihito *et al.* (1984) and Suzuki and Masuda (1993) reported this species from Miyagi Prefecture on the northeastern side of Honshu south to Oita Prefecture in northeastern Kyushu. *Gymnogobius macrognathos* inhabits brackish waters.

Remarks. This species has been the source of a great deal of confusion. It was originally described as scaleless: "capite totoque corpore alepidotis et vestigiis squamarum nullis" (Bleeker 1860: 83). This description led Günther (1861) to place the species in *Gobiosoma*, and Gill (1863) to establish the genus *Gymnogobius*. Based on a communication from Van Lidth de Jeude of the University of Leiden, Jordan and Snyder (1900) began to doubt that this species was scaleless and included it in *Chaenogobius*. However, Jordan and Snyder (1901b) and several later

authors (Berg 1916; Jordan and Hubbs 1925; Jordan and Tanaka 1927; Mori 1928) were clearly referring to a different species (*G. urotaenia*) in their discussions of *G. macrognathos*. Koumans (1931) examined the holotype and found that the specimen has obvious "pouches" that once had held scales; therefore, the species was not scaleless, but the scales had simply fallen off. Tomiyama (1936) recognized that the *G. macrognathos* of Jordan and Snyder (1901b) was not identical with *G. macrognathos* of Bleeker (1860) and was the first to provide an accurate description (including scales) of the true *G. macrognathos*.

The original spelling of the specific name of this species was *macrognathos* (Bleeker 1860). This spelling was retained by Günther (1861), but emended to *macrognathus* by Gill (1863) with no explanation. Subsequent authors have used both spellings. Article 33.3.1 of the Fourth Edition of the International Code of Zoological Nomenclature (International Commission on Zoological Nomenclature, 1999) allows for the maintenance of altered subsequent spellings if they are in prevailing usage (i.e. "...adopted by at least a substantial majority of the most recent authors..."). Although *macrognathus* has been more commonly used by recent authors, it is not clearly in prevailing usage as defined by the ICZN; therefore this author prefers to maintain the original spelling of *macrognathos*.

The distribution of *G. macrognathos* is poorly known. Specimens examined in this study are from three widely separated localities. Akihito *et al.* (1984) and Suzuki and Masuda (1993) reported it from only the Pacific side of central Japan, yet Russian authors have collected confirmed specimens from Peter the Great Bay and the western Yellow Sea; there are no reports of this species in Korean waters. This species thus either consists of several isolated relict populations, or its distribution is much more extensive than currently believed. Additional collecting on the Korean Peninsula and the western side of Japan may eventually close these distribution gaps.

Comparative remarks. *Gymnogobius macrognathos* can be distinguished from *G. cylindricus* and *G. scrobiculatus* by the lack of an overhanging upper jaw and greater distance between posterior interorbital pores. Unlike *G. uchidai*, *G. macrognathos* has no barbel-like processed behind the chin.

Gymnogobius uchidai (Takagi, 1957), n. comb.
[Japanese name *chikuzenhaze*]
(Figs 4I, 7C, D)

Paleatogobius uchidai Takagi, 1957: 118–120, fig. 6 (type locality: Kanakuzu R., Fukuoka, Japan).
Chaenogobius uchidai: Akihito *et al.* 1984: 278, pl. 253-C.

Type material. *Paleatogobius uchidai*: USNM 215275, paratype, 29.0 mm, Kanakuzu R., Fukuoka, Japan, Ootu.

Additional material. HUMZ 88096, 25.1 mm, Usu Bay, Hokkaido, Japan; HUMZ 89734, 28.5 mm, Usu Bay, Hokkaido, Japan, Sawada; HUMZ 89735, 27.8 mm, Usu Bay, Hokkaido, Japan, Sawada; BLIH 1990120, 10 (24.5–29.0 mm), Obitu River, Kisarazu, Chiba Prefecture, Honshu, Japan, Hosoya and Ikeda.

Diagnosis. Species of *Gymnogobius* unique in having pair of distinct, fleshy,

barbel-like processes behind chin. Further characterized by following combination of characters: head somewhat broad, its width approximately equal to its depth; anterior oculoscapular canals extending only to postorbital region, opening through paired C, D, and F pores; right and left D pores distinct; one sensory papilla in row *n*; lower jaw protruding anteriorly beyond upper jaw; maxilla extending posteriorly beyond posterior margin of eye and beyond margin of gape; dark pigment patches forming vertical bands extending to lateral line region but not onto belly; caudal fin translucent, pale yellow, with dark blotches forming distinct bands on upper and middle rays; predorsal scales absent; modal vertebral count 15+19; first dorsal fin with six spines, anteriormost pterygiophore inserted in fourth interneural space; modal second dorsal-fin ray count I,11, anteriormost pterygiophore usually inserted in 12th interneural space; modal anal-fin ray count I,10, anal fin origin anterior to third soft ray of second dorsal fin; first dorsal fin with small, dark blotches forming several oblique bands.

Description. Body elongate, its depth approximately 15% of SL; caudal peduncle slender, its depth 8–9% of SL. Scales small, ctenoid, covering entire body from base of pectoral fin to caudal fin, but absent on dorsum anterior to second dorsal fin and on sides dorsal to pectoral fin base; head naked; scales in longitudinal series approximately 45, scales in transverse series approximately 12. Several rows of sensory papillae in abdominal region; *lm* series of sensory papillae obscure.

Head cylindrical, its width approximately equal to its depth, with broad, low bulge on snout; eye diameter approximately 22% of head length; interorbital space narrow, its width less than orbital diameter; mouth large, directed slightly upward; lower jaw protruding slightly beyond upper jaw; maxilla extending posteriorly beyond posterior margin of orbit and beyond perimeter of gape, its posterior end not attached to cheek; small, conical premaxillary and dentary teeth in four irregular rows; pair of distinct, fleshy, barbel-like processes behind chin; gill rakers short, slender, without tooth patches, 2+10. Anterior oculoscapular canals opening through paired C, D, and F pores (Fig. 4G); right and left D pores well separated; four suborbital rows of sensory papillae oriented longitudinally; one sensory papilla in row *n*, posteromedial to F pore.

Dorsal fins approximately equal in height and separated, not connected by membrane; first dorsal fin V–VI (VI); DF somewhat variable, modally 4-12201000; second dorsal fin I,10–11 (I,11), anteriormost pterygiophore inserted in 12th interneural space; anal fin I,9–11 (I,10), its origin ventral or anterior to third soft ray of second dorsal fin; AP 2–3 (3); pectoral fin rounded, not extending to posterior margin of first dorsal fin, pectoral fin rays 18–20 (20); segmented caudal-fin rays 9+8, branched caudal-fin rays 7+6; vertebrae 15–16+18–19 (15+19).

Color in alcohol. Head and body brown, becoming yellowish-white on ventral surface; tiny dark brown or black spots forming distinct, narrow, dorsoventrally oriented bands on sides down to lateral line region; dark spots generally less dense, and often completely absent, on ventral surface. First and second dorsal fins with several distinct dark longitudinal bands; first dorsal fin with vague dark blotch near posterior margin; anal fin dusky; caudal fin translucent, slightly yellow with distinct dark-brown transverse bands; pectoral fin pale yellow with irregularly placed small, dark-brown spots. In life, abdominal area, prepectoral area and lower opercula silvery white. Posterior half of body somewhat translucent.

Distribution. Specimens examined are from southern Hokkaido, the Pacific

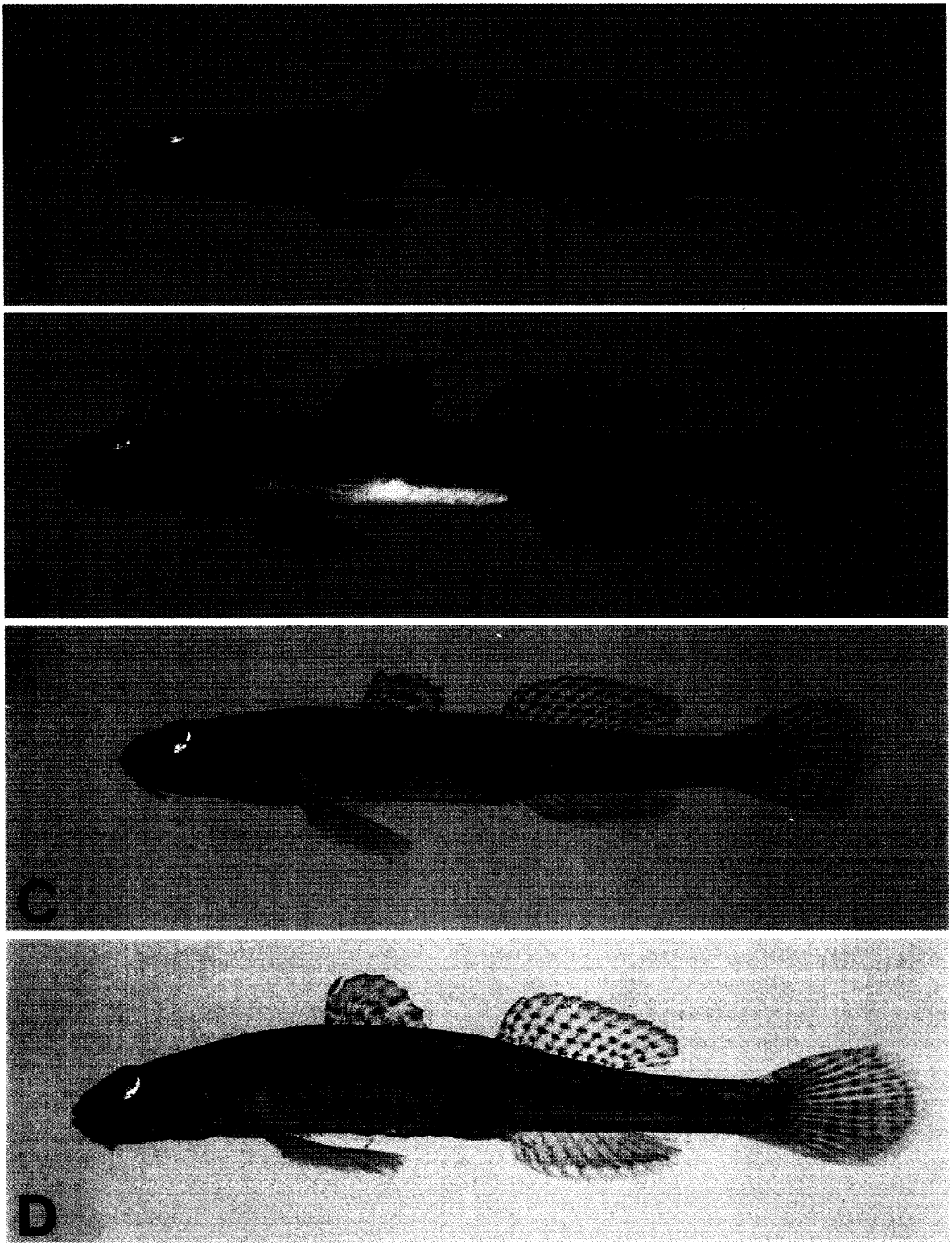

Fig. 7. Photographs of gobies. A, *Gymnogobius macrognathos*, male, BLIH 1990007-3; B, *G. macrognathos*, female, BLIH 1990007-4; C, *G. uchidai*, male, BLIH 1990120-3; D, *G. uchidai*, female, BLIH 1990120-10. Photos by Y. Ikeda.

side of central Honshu, and northern Kyushu. This species has been reported from Hokkaido to southern Kyushu in Japan (Akihito *et al.* 1984; Suzuki and Masuda 1993). *Gymnogobius uchidai* inhabits brackish and shallow marine waters.

Remarks. Takagi (1957) established the genus *Paleatogobius* to accommodate this species, believing that its most distinctive character (a pair of distinct, fleshy, barbel-like processes behind the chin) warranted placement of the species in a separate genus. Subsequent authors (e.g., Akihito *et al.* 1984; Suzuki and Masuda 1993) have largely disagreed. *Gymnogobius uchidai* is very similar to the *G. macrognathos–cylindricus–scrobiculatus* group, sharing with them more characters than do other species in the genus. Although a phylogeny for this genus has not been hypothesized, establishment of a separate genus for *G. uchidai* would most likely render *Gymnogobius* paraphyletic, and *Paleatogobius* is therefore considered a junior synonym.

Comparative remarks. *Gymnogobius uchidai* is the only species in this genus with fleshy, barbel-like processes behind the chin. This species is most similar to *G. macrognathos*, but can be distinguished from the latter species by the presence of imbricate scales and the anterior extent of the lower jaw, in addition to the presence of the barbel-like processes.

Gymnogobius heptacanthus (Hilgendorf, 1879)
[Japanese name *nikuhaze*; Korean name *sal-mang-dug*]
(Fig. 4J)

Gobius heptacanthus Hilgendorf, 1879: 110–111 (type locality: Jedo, Japan).
Aboma heptacantha: Jordan and Snyder 1901b: 70–71.
Chloea sarchynnis Jordan and Snyder, 1901b: 82–83, fig. 15 (type locality: Wakanoura, Honshu, Japan). [Synonymized by Tomiyama (1936)]
Gymnogobius sarchynnis: Taranetz 1934: 397–399.
Chaenogobius heptacanthus heptacanthus: Tomiyama 1936: 91–92. [Synonymized by Pinchuk (1984)]
Chloea nigripinnis Wang and Wang, 1935: 187–189, fig. 17 (type locality: Chefoo, China). **N. syn.**
Chaenogobius heptacanthus: Mori 1952: 143.
Chaenogobius nigripinnis: Fowler 1961: 68–69, fig. 42.
Gymnogobius nigripinnis: Lindberg and Krasyukova 1975: 375–378, fig. 291.
Gymnogobius heptacanthus: Lindberg and Krasyukova 1975: 382–383, fig. 297.

Type material. *Gobius heptacanthus*: ZMB 10656, holotype, 42.0 mm, Jedo, Japan, Hilgendorf. *Chloea sarchynnis*: CAS 106463, holotype, 31.5 mm, Wakanoura, Honshu, Japan, Jordan and Snyder; CAS 106653, paratypes, 4 (26.3–28.3), Wakanoura, Honshu, Japan, Jordan and Snyder.

Additional material. HUMZ 70706, 48.1 mm, Kamiiso, Hokkaido, Japan; HUMZ 132979, 26.7 mm, Obira, Rumoi, Hokkaido, Japan, Muto; HUMZ 132980, 24.5 mm, Obira, Rumoi, Hokkaido, Japan, Muto; HUMZ 132995, 27.0 mm, Obira, Rumoi, Hokkaido, Japan, Muto; LACM 44370-2, 7 (26.7–34.5 mm), Mutsu Bay, Japan, McLean; NSMT-P 18709, 7 (30.8–36.7 mm), Hakodate Bay, Hokkaido, Japan; NSMT-P 34354, 50.0 mm, Sagami Bay, Japan, Aizawa; NSMT-P 34355, 47.0 mm, Sagami Bay,

Japan, Aizawa; NSMT-P 34356, 44.4 mm, Sagami Bay, Japan, Aizawa; ZISP 22172, 3 (34.0–40.0 mm), Vladivostok market, Russia, Rutenberg; ZISP 35624, 2 (38.3–38.6 mm), Chefoo, Yellow Sea, China.

Diagnosis. Species of *Gymnogobius* unique in having only three longitudinal rows of sensory papillae below eye. Further characterized by following combination of characters: head narrow and laterally compressed, its depth greater than its width; anterior oculoscapular canals extending beyond postorbital region, opening through paired C, D, F, and G pores; right and left D pores distinct; one sensory papilla in row *n*; lower jaw protruding anteriorly beyond upper jaw; maxilla extending posteriorly to posterior margin of eye and beyond margin of gape; posterolateral end of mental flap indistinct; no fleshy, barbel-like processes behind chin; dark pigment patches concentrated on dorsum and around lateral line area, not extending onto lower part of body; caudal fin dusky, with dark blotches forming indistinct bands; 1–3 predorsal scales; 67–75 scales in longitudinal series; modal vertebral count 17+21; first dorsal fin with seven spines, anteriormost pterygiophore inserted in fourth interneural space; modal second dorsal-fin ray count I,12, anteriormost pterygiophore usually inserted in 13th interneural space; modal anal-fin ray count I,12, anal fin origin anterior to third soft ray of second dorsal fin; first dorsal fin with small, dark blotches forming several oblique bands; mature females with dark blotch near posterior margin of first dorsal fin.

Description. Body elongate, its depth 12–14% of SL; caudal peduncle slender, its depth 8–9% of SL. Scales small, ctenoid, covering entire body from base of pectoral fin to caudal fin, on dorsum extending anterior to first dorsal fin in most specimens; head naked; scales in longitudinal series 67–75, scales in transverse series 17–19; predorsal scales 1–3. Several rows of sensory papillae in abdominal region; 32–34 vertical rows of sensory papillae in *lm* series.

Head narrow, somewhat laterally compressed, its depth greater than its width, with broad bulge on snout; eye diameter approximately 25% of head length; interorbital space narrow, its width less than orbital diameter; mouth large, directed slightly upward; lower jaw protruding slightly beyond upper jaw; maxilla extending posteriorly beyond posterior margin of orbit and beyond perimeter of gape, its posterior end not attached to cheek; small, conical premaxillary and dentary teeth in four irregular rows; lateral margins of mental flap continuous posteriorly, its lateral margins not produced into fleshy, barbel-like processes; gill rakers somewhat elongate, slender, without tooth patches, 6+18. Anterior oculoscapular canals opening through paired C, D, F, and G pores (Fig. 4H); right and left D pores well separated; three suborbital rows of sensory papillae oriented longitudinally; one sensory papilla in row *n*, directly dorsomedial to F pore.

Dorsal fins approximately equal in height and separated, not connected by membrane; first dorsal fin VII; DF somewhat variable, modally 4-122110000; second dorsal fin I,10–12 (I,12), anteriormost pterygiophore inserted in 12th–13th (13th) interneural space; anal fin I,11–13 (I,12), its origin ventral or anterior to third soft ray of second dorsal fin; AP 3–4 (3); pectoral fin rounded, not extending to posterior margin of first dorsal fin, pectoral fin rays 19–21 (19); segmented caudal-fin rays 9+8, branched caudal-fin rays 7+6; vertebrae 15–17+20–22 (17+21).

Color in alcohol. Head and body light brown, becoming yellowish-white on ventral surface; tiny dark brown spots covering dorsal surface of head and forming dark blotch anterior to eye; series of dark patches on dorsal surface of body and in

lateral line region, lateral dark patches often fused to form broad longitudinal stripe, becoming darker on posterior half of body and forming triangular blotch at base of caudal fin; ventral surface without dark pigment. First and second dorsal fin with several distinct dark longitudinal bands; first dorsal fin in females with prominent dark blotch near posterior margin; anal fin dusky; caudal fin yellowish and translucent, with distinct dark-brown transverse bands on all rays; pectoral fin pale yellow with irregularly placed small, dark-brown spots.

Distribution. Specimens examined are from the Pacific side of central Honshu, the waters surrounding the Tsugaru Strait, and western Hokkaido in Japan, as well as the southern Maritime Territory (presumably Peter the Great Bay) in the Russian Far East and in the Yellow Sea at Chefoo on the Chinese coast. This species has been reported from Miyagi Prefecture on Honshu south to Kyushu in Japan (Akihito *et al.* 1984). It has also been reported from Wonsan, North Korea (Mori 1928), and throughout the South Korean coast (Chyung 1954, 1977; Kim *et al.* 1987). *Gymnogobius heptacanthus* inhabits shallow marine waters.

Remarks. The nominal species *Chloea nigripinnis* was described from eight specimens collected at Chefoo in the Yellow Sea. These specimens were deposited in the Museum of the Biological Laboratory of the Science Society of China, an institution which has not existed in China for some time, and the whereabouts of these and other specimens of this collection are unknown (He Shunping, pers. comm., 2 November 1998). In the original description of this species (Wang and Wang 1935: 189), the authors stated that "This new species is very closely related to *C. mororana* and *C. sarchynnis* [=*Gymnogobius heptacanthus*]; but it differs from the latter, by having [a] large mouth, and much dark[er] fins." As we now know, the females of many if not all the species of this genus (including *G. heptacanthus*) show dark coloration of the branchiostegal area and fins. That the authors were examining female specimens is evident by the statement (p. 188), "Seven cotypes from the same locality, and of about equal size, some ones with numerous eggs, that indicate the fishes are quite in maturity." The mouth of *G. mororanus* is not significantly larger than that of *G. heptacanthus*, which has the maxilla extending posteriorly to or well beyond the posterior margin of the eye. In addition, all meristic values (with the exception of scale counts) fall within the observed range for *G. heptacanthus*, and *G. heptacanthus* has been collected at the same locality. Therefore, even without the type series, it can be reasonably concluded that *Chloea nigripinnis* is a synonym of *G. heptacanthus*.

Comparative remarks. *Gymnogobius heptacanthus* is very similar to *G. mororanus*. Both species have laterally compressed heads and elevated vertebral counts. However, *G. heptacanthus* is the only species in this genus with three longitudinal rows of sensory papillae below the eye. It can also be distinguished from *G. mororanus* by having fewer scales in longitudinal series, a dark blotch on the first dorsal fin in females, a vertebral count of 17+21, and a larger eye (25% of HL vs. 18–22% of HL).

Gymnogobius mororanus (Jordan and Snyder, 1901)
[Japanese name *hebihaze*; Korean name *eol-nug-mang-dug*]
(Fig. 4K)

Chloea mororana Jordan and Snyder, 1901b: 80–82, fig. 14 (type locality: Mororan [Muroran], Hokkaido, Japan).
Chloea bungei Shmidt, 1931: 119–120, fig. 5 (type locality: Port Shestakoff, North Korea). **N. syn.**
Chloea bungeri [sic]: Mori and Uchida 1934: 30.
Gymnogobius mororanus: Taranetz 1934: 398.
Chaenogobius heptacanthus murorana [sic]: Tomiyama 1936: 92. [Synonymized by Pinchuk (1984)]
Chaenogobius mororana: Mori 1952: 143.
Chaenogobius murorana [sic]: Matsubara 1955: 839.
Gymnogobius bungei: Lindberg and Krasyukova 1975: 379–381.
Chaenogobius mororanus: Pinchuk 1978: 9.
Chaenogobius bungei: Pinchuk 1984: 67.

Type material. *Chloea mororana*: CAS 106452, holotype, 61.8 mm, Mororan [Muroran], Hokkaido, Japan, Jordan and Snyder; CAS 106619, paratypes, 19 (33.0–55.4 mm), Matsushima Bay, Honshu, Japan, Jordan and Snyder. *Chloea bungei*: ZISP 23107, syntypes, 3 (41.0–59.3 mm), Port Shestakoff, North Korea, Bunge.

Additional material. HUMZ 43158, 64.5 mm, Usu, Hokkaido, Japan; HUMZ 43203, 63.3 mm, Usu, Hokkaido, Japan; HUMZ 43226, 52.8 mm, Usu, Hokkaido, Japan; HUMZ 43237, 65.2 mm, Usu, Hokkaido, Japan; HUMZ 43264, 51.3 mm, Usu, Hokkaido, Japan; NSMT-P 45256, 7 (54.0–63.0 mm), Chikara-kotan, Akkeshi Lake, Hokkaido, Japan, Yabe and Muto; NSMT-P 45430, 70.5 mm, Akkeshi Lake, Hokkaido, Japan, Minami; NSMT-P 45537, 2 (35.6–42.5 mm), Akkeshi Lake, Hokkaido, Japan, Minami; USNM 71424, 21 (23.5–45.3 mm), Shiogama Rikuzen, Honshu, Japan; ZISP 40951, 2 (66.8–74.0 mm), Shikotan Island, Kuril Islands, Rutenberg.

Diagnosis. Species of *Gymnogobius* unique in having more than 80 scales in longitudinal series. Further characterized by following combination of characters: head narrow and laterally compressed, its depth greater than its width; anterior oculoscapular canals extending beyond postorbital region, opening through paired C, D, F, and G pores; right and left D pores distinct; one sensory papilla in row *n*; lower jaw protruding anteriorly beyond upper jaw; maxilla extending posteriorly beyond posterior margin of eye and beyond margin of gape; posterolateral end of mental flap indistinct; no fleshy, barbel-like processes behind chin; dark pigment patches forming vermiculations on dorsum and vertical bands extending to lateral line area, but not extending onto lower part of body; caudal fin dusky, with dark blotches forming indistinct bands; 0–8 predorsal scales; 89–101 scales in longitudinal series; modal vertebral count 16+22; first dorsal fin usually with seven spines, anteriormost pterygiophore inserted in fourth interneural space; modal second dorsal-fin ray count I,12, anteriormost pterygiophore usually inserted in 13th interneural space; modal anal-fin ray count I,12, anal fin origin anterior to third soft ray of second dorsal fin; first dorsal fin with small, dark blotches forming several oblique bands.

Description. Body elongate, its depth 13–15% of SL; caudal peduncle slender, its depth 7–9% of SL. Scales minute, very weakly ctenoid, covering entire body from base of pectoral fin to caudal fin, on dorsum extending anterior to first dorsal fin in most specimens; head naked; scales in longitudinal series 89–101, scales in transverse series 25; predorsal scales 0–8. Several rows of sensory papillae in abdominal region; 32–34 vertical rows of sensory papillae in *lm* series.

Head narrow, laterally compressed, its depth greater than its width, with broad bulge on snout; eye diameter 18–22% of head length; interorbital space narrow, its width less than orbital diameter; mouth large, directed slightly upward; lower jaw protruding slightly beyond upper jaw; maxilla extending posteriorly beyond posterior margin of orbit and beyond perimeter of gape, its posterior end not attached to cheek; small, conical premaxillary and dentary teeth in four irregular rows; posterolateral end of mental flap indistinct; no fleshy, barbel-like processes behind chin; gill rakers somewhat elongate, slender, without tooth patches, 4–7+16–17 (6+17). Anterior oculoscapular canals opening through paired C, D, F, and G pores (Fig. 4I); right and left D pores well separated; four suborbital rows of sensory papillae oriented longitudinally; one sensory papilla in row *n*, directly dorsomedial to F pore.

Dorsal fins approximately equal in height and separated, not connected by membrane; first dorsal fin VII–VIII (VII); DF highly variable, modally 4-122110000; second dorsal fin I,10–14 (I,12), anteriormost pterygiophore inserted in 12th–14th (13th) interneural space; anal fin I,11–13 (I,12), its origin ventral or anterior to third soft ray of second dorsal fin; AP 3–4 (3); pectoral fin rounded, not extending to posterior margin of first dorsal fin, pectoral fin rays 21–23 (22); segmented caudal-fin rays 9+8, branched caudal-fin rays 7+6; vertebrae 16–17+21–23 (16+22).

Color in alcohol. Head and body light brown, becoming yellowish-white on ventral surface; tiny dark-brown spots covering dorsal surface of head and forming dark blotch anterior to eye; series of dark vermiculations on dorsal surface of body, extending onto lateral line region as series of broad, irregular, and dark vertical bars, these becoming less distinct on posterior half of body; ventral surface without dark pigment. First and second dorsal fins with several distinct dark longitudinal bands; anal fin dusky; caudal fin yellowish and translucent, with distinct dark-brown transverse bands on all rays; pectoral fin pale yellow with irregularly placed small, dark-brown spots.

Distribution. Specimens examined are from both sides of central Honshu and from southwestern and eastern Hokkaido in Japan, as well as Shikotan Island in the Kuril Islands and Port Shestakoff (i.e. Seikoshin) on the North Korean coast. This species has been reported from Hokkaido to Chiba Prefecture in Japan (Akihito *et al.* 1984) and throughout coastal South Korea (Chyung 1954, 1977; Kim *et al.* 1987). *Gymnogobius mororanus* inhabits shallow marine and brackish waters.

Remarks. The nominal species *Chloea bungei* Schmidt, 1931 was described as having "Three rows of pores below eye" (Schmidt 1931: 119), which would indicate that it may be synonymous with *Gymnogobius heptacanthus*. However, all three of its syntypes actually have four rows of sensory papillae below the eye, as well as more than 80 lateral scales in longitudinal series and small eye size, features held in common with *G. mororanus*. Therefore, *C. bungei* is considered a junior synonym of *G. mororanus*.

Comparative remarks. *Gymnogobius mororanus* is very similar to *G. hepta-*

canthus but can be distinguished from the latter species by the presence of four longitudinal rows of sensory papillae below the eye, greater number of scales in longitudinal series, a vertebral count of 16+22, and smaller eye size. There is no dark blotch on the posterior margin of the first dorsal fin in the female.

Gymnogobius isaza (Tanaka, 1916), n. comb.
[Japanese name *isaza*]
(Figs 4L, 8A)

Chaenogobius macrognathos: Jordan and Snyder 1900: 372. [Nec Bleeker, 1860]
Chaeuogobius [sic] *isaza* Tanaka, 1916: 102–103 (type locality: Lake Biwa, Honshu, Japan).
Chaenogobius annularis urotaenia: Tomiyama 1936: 91 (in part). [Nec Hilgendorf, 1879] **N. syn.**
Chaenogobius isaza: Takagi 1952: 14–22.

Type material. *Chaenogobius isaza*: ZUMT 57520, holotype, 49.3 mm, Lake Biwa, Honshu, Japan.

Additional material. BMNH 1898.12.1.4–8, 5 (41.0–42.5 mm), Lake Biwa, Honshu, Japan, Kishinouye; LACM 44899-1, 3 (30.0–51.1 mm), Lake Biwa, Japan; NSMT-P 14242, 8 (46.3–64.8 mm), Lake Biwa, Japan; NSMT-SK 3053, 13 (46.3–64.9 mm), Lake Biwa, Japan; UW 07817, 18 (21.0–50.0 mm), Lake Biwa, Japan.

Diagnosis. Species of *Gymnogobius* unique in having sensory papillae of cheek oriented in both longitudinal and transverse rows. Further characterized by following combination of characters: head broad and depressed, its width greater than its depth; anterior oculoscapular canals extending beyond postorbital region, opening through paired C, D, F, and G pores; right and left D pores distinct; several sensory papillae in row *n*; lower jaw protruding anteriorly beyond upper jaw; maxilla extending posteriorly to posterior margin of eye; posterolateral end of mental flap indistinct; no fleshy, barbel-like processes behind chin; dark pigment patches forming broad bands on sides of body; caudal fin dusky, with dark blotches forming distinct bands; predorsal scales absent; 57–65 scales in longitudinal series; modal vertebral count 15+18; first dorsal fin usually with six spines, anteriormost pterygiophore inserted in fourth interneural space; modal second dorsal-fin ray count I,10, anteriormost pterygiophore usually inserted in 11th interneural space; modal anal-fin ray count I,10, anal fin origin anterior to third soft ray of second dorsal fin; first dorsal fin predominantly dark with no bands or indistinct broad bands, and dark blotch on posterior margin.

Description. Body elongate, its depth approximately 14% of SL; caudal peduncle slender, its depth approximately 8% of SL. Scales small, weakly ctenoid anteriorly, becoming visibly ctenoid posteriorly, covering entire body from base of pectoral fin to caudal fin but absent on dorsum anterior to space between dorsal fins and on sides dorsal to pectoral fin base; head naked; scales in longitudinal series 57–65, scales in transverse series 13–18. Several rows of sensory papillae in abdominal region; sensory papillae in *lm* series obscure.

Head broad and depressed, its width greater than its depth, with broad bulge on snout; eye diameter approximately 25% of head length; interorbital space nar-

row, its width less than orbital diameter; mouth large, directed slightly upward; lower jaw protruding slightly beyond upper jaw; maxilla extending posteriorly to or beyond posterior margin of orbit; small, conical premaxillary and dentary teeth in four irregular rows; posterolateral end of mental flap indistinct; no fleshy, barbel-like processes behind chin; gill rakers short, slender, without tooth patches, 1–4+11–13 (3+12). Anterior oculoscapular canals opening through paired C, D, F, and G pores (Fig. 4J); right and left D pores well separated; four suborbital rows of sensory papillae oriented longitudinally and approximately six transverse rows of sensory papillae on cheek; several sensory papillae in row *n*, directly dorsomedial to F pore.

Dorsal fins approximately equal in height and separated, not connected by membrane; first dorsal fin V–VII (VI); DF highly variable, modally 4-1211100; second dorsal fin I,10–12 (I,10), anteriormost pterygiophore inserted in 11th–12th (11th) interneural space; anal fin I,9–11 (I,10), its origin ventral or anterior to third soft ray of second dorsal fin; AP 2–4 (3); pectoral fin rounded, not extending to posterior margin of first dorsal fin, pectoral fin rays 18–20 (19); segmented caudal-fin rays 9+8, branched caudal-fin rays 7+6; vertebrae 14–15+17–19 (15+18).

Color in alcohol. Head and body brown, becoming yellowish-white on ventral surface; tiny dark brown or black spots covering most of dorsum, forming series of broad, vertical bands on sides and indistinct dark blotch at base of caudal fin; dark spots generally less dense, and often completely absent, on ventral surface of body and on pelvic fins; first dorsal fin with dark margin, unpigmented submarginal band, three indistinct, dark, transversely oriented bands, and large dark blotch at posterior margin; second dorsal, caudal, and anal fins with small, dark spots and several indistinct bands, but without spots along margins; pectoral fin heavily spotted near base, more sparsely spotted elsewhere. Branchiostegal region, pelvic fins, and anal fin black in spawning females.

Distribution. This species is endemic to Lake Biwa on Honshu, Japan. Akihito *et al.* (1984) also reported that it has been introduced to Lake Kasumigaura and Lake Sagami.

Remarks. At least some of the specimens that Dr. Kishinouye collected from Lake Biwa (BMNH 1898.12.1.4–8), referred to by Jordan and Snyder (1900) as *Chaenogobius macrognathos* (=*Gymnogobius macrognathos*), represent *G. isaza*. However, they were not recognized as a distinct species at that time.

Comparative remarks. *Gymnogobius isaza*, *G. petschiliensis*, *G. opperiens*, and *G. urotaenia* form a very similar species group (hereafter referred to as the *G. urotaenia* species group). *Gymnogobius isaza* can be distinguished from the other members of this group by the lack of predorsal scales, the presence of transverse rows of sensory papillae on the cheek, and the comparatively narrow caudal peduncle.

Gymnogobius petschiliensis (Rendahl, 1924), n. comb.
[Japanese name *sumi-ukigori*]
(Figs 4M, 8B)

Gobius petschiliensis Rendahl, 1924: 20–22 (type locality: Qinhuangdao, Shanghaiguan, Hebei Province, China).

Chaenogobius sp. 2: Akihito *et al.* 1984: 277, fig. 178, pl. 252P.
Chaenogobius transversefasciatus Wu and Zhou, 1990: 144–148, figs 1, 2 (type locality: Cangnan Shuitou, Ao-jiang R., Zhejiang Province, China). **N. syn.**

Type material. *Gobius petschiliensis*: NRM 10621, syntypes, 4 (56.8–80.0 mm), Qinhuangdao, Shanghaiguan, Hebei Province, China. *Chaenogobius transversefasciatus*: BLIH 1984387, paratype, 49.5 mm, Cangnan Shuitou, Ao-jiang R., Zhejiang Province, China.

Additional material. HUMZ 50578, 45.6 mm, Hikken River, Ishimiyokota, Masuda, Shimane Honshu, Japan, Sawada; HUMZ 50579, 41.0 mm, Ishimiyokota, Masuda, Shimane, Honshu, Japan, Sawada; HUMZ 50582, 35.1 mm, Ishimiyokota, Masuda, Shimane, Honshu, Japan, Sawada; HUMZ 50648, 42.5 mm, Oomisawa River, Kominato, Chiba, Honshu, Japan, Sawada; NSMT-P 5605, 56.7 mm, Izumi River, Tsushima Island, Japan; NSMT-P 11067, 2 (86.4–99.1 mm), Akka River, Iwate, Honshu, Japan; NSMT-P 14373, 5 (49.3–79.5 mm), Okawa River, Shizuoka, Honshu, Japan, Takeuchi; NSMT-P 14396, 9 (36.6–97.2 mm), Nishina River, Shizuoka, Honshu, Japan, Takeuchi; NSMT-P 20966, 3 (52.9–67.1 mm), Inasa, Shizuoka, Honshu, Japan; NSMT-P 21267, 58.8 mm, Amatsukominato-cho, Chiba, Honshu, Japan; NSMT-P 29077, 5 (49.6–74.6 mm), Nagata River, Kamikaya, Yakushima Island, Japan; NSMT-P 29082, 47.9 mm, Nagata River, Kamikaya, Yakushima Island, Japan; NSMT-P 29091, 4 (40.2–45.3 mm), Nagata River, Kamikaya, Yakushima Island, Japan; NSMT-SK 2701, 10 (36.3–72.2 mm), Japan; NSMT-SK 4542, 80.5 mm, Japan; NSMT-P 59485, 75.0 mm, Ibaraki Nature Museum.

Diagnosis. Species of *Gymnogobius* characterized by following combination of characters: head broad and depressed, its width greater than its depth; anterior oculoscapular canals extending beyond postorbital region, opening through paired C, D, F, and G pores; right and left D pores distinct, separated by more than one-third orbital diameter; one sensory papilla in row *n*; lower jaw protruding anteriorly beyond upper jaw; maxilla extending posteriorly to or beyond posterior margin of eye; posterolateral end of mental flap indistinct; no fleshy, barbel-like processes behind chin; dark pigment patches forming series of broad bands on side of body and distinct, wedge-shaped blotch at base of caudal fin; caudal fin dusky, with dark blotches forming broad, distinct bands; 23–31 predorsal scales; 62–72 scales in longitudinal series; modal vertebral count 15+17; first dorsal fin usually with six spines, anteriormost pterygiophore usually inserted in fourth interneural space; modal second dorsal-fin ray count I,10, anteriormost pterygiophore usually inserted in 11th interneural space; modal anal-fin ray count I,10, anal fin origin anterior to third soft ray of second dorsal fin; first dorsal fin with distinct wavy bands, and no dark blotch on posterior margin.

Description. Body moderately elongate, its depth 17–22% of SL; caudal peduncle broad, its depth 11–13% of SL. Scales small, weakly ctenoid anteriorly, becoming clearly ctenoid posteriorly, covering entire body from base of pectoral fin to caudal fin, on dorsum extending anterior to first dorsal fin; head naked; scales in longitudinal series 62–72, scales in transverse series 18–22; predorsal scales 23–31. Several rows of sensory papillae in abdominal region; 25–30 vertical rows of sensory papillae in *lm* series.

Head broad and depressed, its width greater than its depth, with broad bulge on snout; eye diameter 17–22% of head length; interorbital space broad and flat, its

width equal to or greater than orbital diameter; mouth large, directed slightly upward; lower jaw protruding slightly beyond upper jaw; maxilla extending posteriorly to or beyond posterior margin of orbit; small, conical premaxillary and dentary teeth in four irregular rows; posterolateral end of mental flap indistinct; no fleshy, barbel-like processes behind chin; gill rakers short, slender, without tooth patches, 3–4+8–9 (3+9). Anterior oculoscapular canals opening through paired C, D, F, and G pores (Fig. 4K); right and left D pores well separated; four suborbital rows of sensory papillae oriented longitudinally; one sensory papilla in row *n*, directly dorsomedial to F pore.

Dorsal fins approximately equal in height and separated, not connected by membrane; first dorsal fin V–VII (VI); DF highly variable, modally 4-1220100; second dorsal fin I,9–11 (I,10), anteriormost pterygiophore inserted in 11th–13th (11th) interneural space; anal fin I,9–11 (I,10), its origin ventral or anterior to third soft ray of second dorsal; AP 2–4 (3); pectoral fin rounded, not extending to posterior margin of first dorsal fin, pectoral fin rays 19–22 (21); segmented caudal-fin rays 9+8, branched caudal-fin rays 7–8+6–7 (7+6); vertebrae 14–17+16–18 (15+17).

Color in alcohol. Head and body brown, becoming yellowish-white on ventral surface; tiny dark-brown or black spots covering most of dorsum, forming a series of broad, vertical bands on sides and distinct wedge-shaped, dark blotch at base of caudal fin; dark spots generally less dense, and often completely absent, on ventral surface of body and on pelvic fins; first dorsal fin with dark margin, unpigmented submarginal band, and three distinct dark, transversely oriented wavy bands; second dorsal, caudal, and anal fins with small dark spots and several indistinct bands, but without spots along margins; pectoral fin heavily spotted near base, more sparsely spotted elsewhere. Branchiostegal region, pelvic fins, and anal fin black in spawning females

Distribution. Specimens examined are from the Yellow Sea coast of Zhejiang and Hebei Provinces in China and from the Pacific side and southwestern tip of Honshu, as well as Tsushima Island and Yakushima Island west and south of Kyushu. Akihito *et al.* (1984) reported this species from Hokkaido to Amami-Oshima in the central Ryukyus, and from the Korean Peninsula, and Pinchuk (1992) reported questionable records from Sakhalin Island. *Gymnogobius petschiliensis* inhabits brackish and freshwater habitats near river mouths.

Remarks. The nominal species *Gobius petschiliensis* has been largely ignored. Only Berg (1933) and Fowler (1961) listed it in synonymies of this genus (as a synonym of *Gymnogobius macrognathos*), and subsequent authors apparently did not consider it relevant to the taxonomy of the genus. Wu and Zhou (1990) redescribed it as *Chaenogobius transversefasciatus* but did not compare it with any of the most closely related species. They included only a brief comparison with *G. mororanus*, from which this species differs considerably, and did not mention any other nominal species in the description. Unfortunately, the holotype and most of the paratypes of *C. transversefasciatus* have been destroyed (H. L. Wu, personal communication, 2 June 2000). However, one paratype was transferred to the Biological Laboratory of the Imperial Household in Japan and represents the only remaining member of the type series. This paratype clearly represents *G. petschiliensis*, agreeing with the syntypes of *G. petschiliensis* in oculoscapular canal and sensory papillae morphology, coloration, and meristics.

In Japan, this species was rediscovered by Nakanishi (1978a, b), who referred

to it as the "brackish water type" of *Chaenogobius annularis* (by which he actually meant *G. urotaenia*). Subsequent Japanese and Russian authors (Akihito *et al.* 1984; Pinchuk 1992) referred to this species as "*Chaenogobius* sp. 2" with no reference to *G. petschiliensis*. Japanese specimens of this form (*Chaenogobius* sp. 2 of Akihito *et al.* 1984) and Chinese specimens (types of *G. petschiliensis* and *C. transversefasciatus*) have the same oculoscapular canal and sensory papillae morphology and coloration, including the distinctive coloration of the first dorsal fin and the presence of one sensory papilla in row *n*. Morphometrics and most meristics for the Japanese and Chinese specimens are also identical; however, there are a few differences. The Chinese specimens tend to have a higher first-dorsal fin ray count (mode=VII vs. VI) and higher vertebral counts (mode=16+18 vs. 15+17) than the Japanese specimens. These discrepancies may represent ecophenotypic differences between these two populations, or it is possible that the two populations represent different species. A large sample of specimens from Chinese and Japanese waters, as well as from the Korean peninsula, will be required for this question to be resolved. Because these two forms cannot be clearly diagnosed, and in the interest of preventing a continued proliferation of nominal species, the Chinese and Japanese forms are here provisionally considered synonymous.

Comparative remarks. *Gymnogobius petschiliensis* can be clearly distinguished from *G. opperiens* and *G. urotaenia* by the presence of distinct indented bands on the first dorsal fin, the lack of a dark blotch on the posterior margin of the first dorsal fin, the presence of a single sensory papilla in row *n*, and a vertebral count of 15+17.

Gymnogobius opperiens n. sp.
[Japanese name *shima-ukigori*]
(Figs 4N, 8C)

Chaenogobius sp. 1: Akihito *et al.* 1984: 277, pl. 252-O; Pinchuk 1992: 129; Nikoforov *et al.* 1994: 27.
Gymnogobius n. sp.: Pietsch *et al.* 2001: 145.

Type material. *Holotype.* NSMT-P 60922 (ex NSMT-P 14366), 67.0 mm, sex undetermined, Yurapu River, Yamagoe, Toshima, Hokkaido, Japan, N. Takeuchi, 8 August 1970. *Paratypes.* HUMZ 40721, 40723, 2 (66.3–70 mm), Otaru, Hokkaido, Japan, Tsumura and Kahata; HUMZ 42113, 42115, 42119, 42127, 42129, 42131, 42152, 42153, 42155, 42171, 10 (51.4–79.5 mm), Shiodomari River, Hakodate, Hokkaido, Japan; HUMZ 70173, 79.5 mm, Kunebetsu River, Hokkaido, Japan; NSMT-P 11055, 65.0 mm, Awaizumi, Komoto River, Iwate Pref., Honshu, Japan; NSMT-P 11090, 4 (58.0–64.0 mm), Kuji River, Iwate Pref., Honshu, Japan; NSMT-P 14366, 54.6 mm, collected with holotype; NSMT-P 14338, 55.6 mm, Mitsuishi River, Hourai, Mitsuishi, Hokkaido, Japan, Takeuchi; NSMT-P 14937, 3 (47.0–49.0 mm), Tuume River, Tugaru-gun, Aomori Pref., Honshu, Japan; NSMT-P 16210, 5 (43.0–52.0 mm), Sabaishi River, Kashiwazaki, Niigata Pref., Honshu, Japan; NSMT-P 18772, 3 (59.0–66.0 mm), Sanriku-cho, Kesen-gun, Iwate Pref., Honshu, Japan; NSMT-P 19291, 69.0 mm, Nishina River, Izu Peninsula, Honshu, Japan, Matsuura; UW 40100, 7 (49.2–81.5 mm), 44°00.47′N, 145°40.98′E, Kunashir Island, Kuril Islands, Pietsch *et al.*; UW

40113, 15 (42.2–62.7 mm)+5 CS, 44°00.47′N, 145°40.98′E, Kunashir Island, Kuril Islands, Pietsch *et al.*; UW 42003, 11 (53.2–76.0 mm), 44°00.25′N, 145°40.34′E, Kunashir Island, Kuril Islands, López; UW 043542, 69 (42.0–75.0 mm), Kunashir Island, Kuril Islands, Stevenson; UW 044225, 22 (49.5–76.5 mm), Shamora River, near Vladivostok, Russia, Shedko.

Additional material. Meristics and measurements not taken from 837 additional specimens (UW 029290, 040101, 040103, 040104, 040106, 040109, 040111, 040115, 040116, 040118, 040195, 040512, 040532, 041387, 042000, 042001, 042007, 042009, 042034, 042036, 042045, 042049, 042223, 042225, 042226, 042229, 043542, 043553) (17–81 mm) from the western side of central Kunashir Island, Kuril Islands, 1995–1999; UW 044808, 2 (54.3–57.3 mm), Lyutoga River, southern Sakhalin Island, Russia, Stevenson, *et al.*; UW 044820, 7 (49.8–62.2 mm), Lyutoga River, southern Sakhalin Island, Russia, Stevenson *et al*; HUMZ 70575, 52.5 mm, Mihogawa, Aomori, Honshu, Japan.

Diagnosis. Species of *Gymnogobius* unique in having dark, y-shaped blotch at base of caudal fin and, in life, white spots on the pectoral fin near its insertion. Further characterized by following combination of characters: head broad and depressed, its width greater than its depth; anterior oculoscapular canals extending beyond postorbital region, opening through paired C, D, F, and G pores; right and left D pores distinct, separated by less than one-third orbital diameter; several sensory papillae in row *n*; lower jaw protruding anteriorly beyond upper jaw; maxilla extending posteriorly to or beyond posterior margin of eye; posterolateral end of mental flap indistinct; no fleshy, barbel-like processes behind chin; dark pigment patches forming series of broad bands on body; caudal fin dusky, with dark blotches forming distinct bands; 19–26 predorsal scales; 71–78 scales in longitudinal series; modal vertebral count 15+18; first dorsal fin usually with six spines, anteriormost pterygiophore usually inserted in fourth interneural space; modal second dorsal-fin ray count I,11, anteriormost pterygiophore usually inserted in 11th interneural space; modal anal-fin ray count I,11, anal fin origin anterior to third soft ray of second dorsal fin; first dorsal fin with distinct oblique bands, and dark blotch on posterior margin.

Description. Body moderately elongate, its depth 12–18% of SL; caudal peduncle broad, its depth 9–12% of SL. Scales deeply embedded and small (not staining with alizarin red S even in largest known specimens), very weakly ctenoid, covering entire body from base of pectoral fin to caudal fin, on dorsum extending anterior to first dorsal fin; head naked; holotype with approximately 75 longitudinal row scales, approximately 21 transverse row scales, and approximately 21 predorsal scales. Several rows of sensory papillae in abdominal region, one row on either side of first dorsal fin and several rows on either side of dorsal midline anterior to first dorsal fin; 30–**31**–32 (31) vertical rows of sensory papillae in *lm* series; genital papilla broad and rounded to slightly pointed, sex not reliably determinable in most specimens. Morphometric character values given in Table 6.

Head broad and depressed, its width greater than its depth, with broad bulge on snout; eye diameter 15–20% of head length; interorbital space broad and flat, its width equal to or greater than orbital diameter; mouth large, directed slightly upward; lower jaw protruding slightly beyond upper jaw; maxilla extending posteriorly to or beyond posterior margin of orbit; small, conical premaxillary and dentary teeth in four irregular rows; posterolateral end of mental flap indistinct; no fleshy, barbel-like processes behind chin; gill rakers short, slender, without tooth

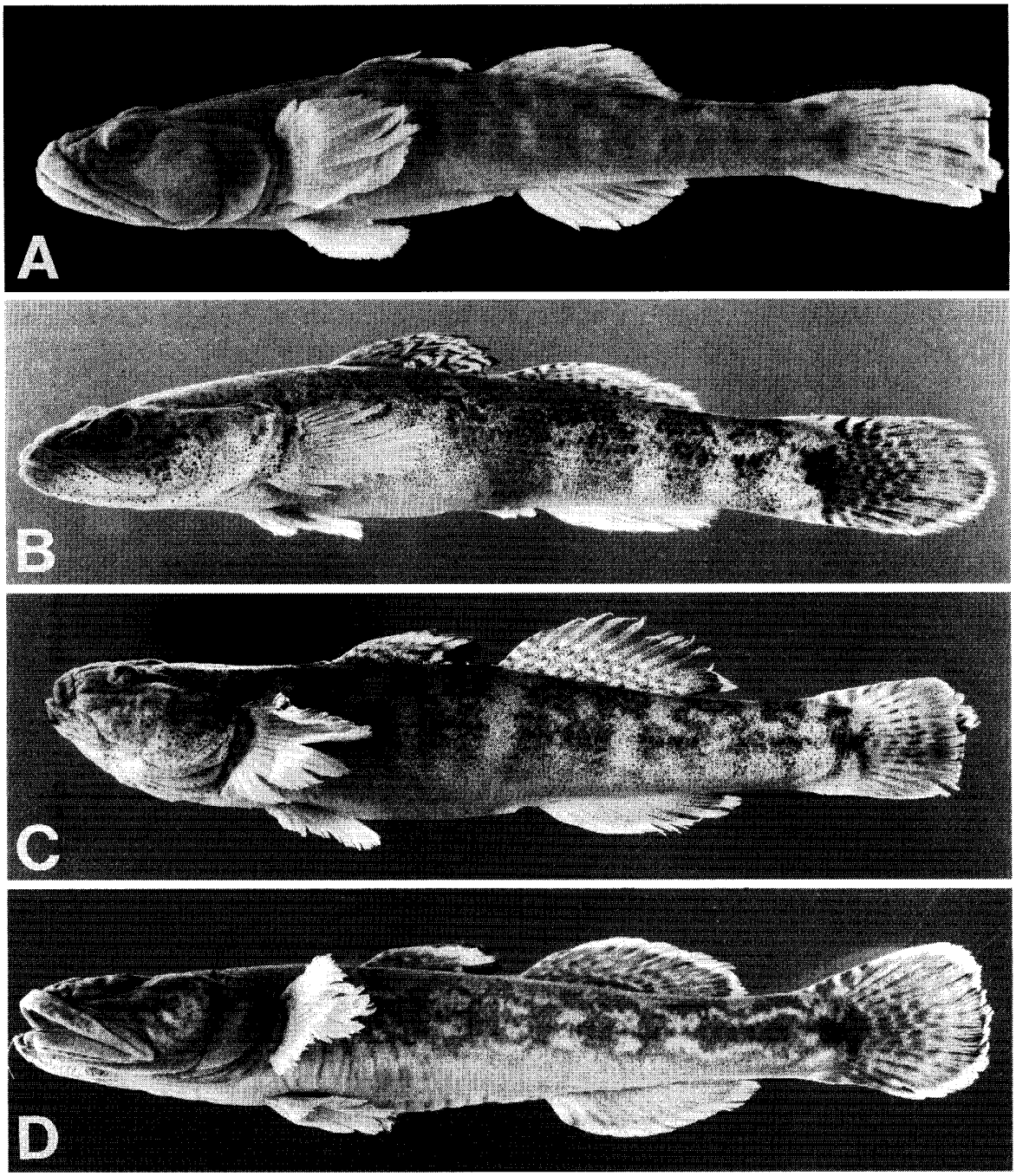

Fig. 8. Photographs of gobies. A, *Gymnogobius isaza*, NSMT-P 14242, 56.0 mm SL; B, *G. petschiliensis*, NSMT-P 14396, 77.4 mm SL; C, *G. opperiens* n. sp., NSMT-P 60922, holotype, 67.0 mm SL; D, *G. urotaenia*, HUMZ 40720, 92.5 mm SL. Photos by P. McGiffert.

patches, 2–**3**+7–**8** (3+8). Anterior oculoscapular canals opening through paired C, D, F, and G pores (Fig. 4L); right and left D pores separated by less than one-third orbital diameter; four suborbital rows of sensory papillae oriented longitudinally; two to six sensory papillae in row *n*, directly dorsomedial to F pore.

Dorsal fins approximately equal in height and separated, not connected by

membrane; first dorsal fin V–**VI** (VI); DF highly variable, modally 4-1220100, **4-1211100** in holotype; second dorsal fin I,10–**11**–12 (I,11), anteriormost pterygiophore inserted in **11th**–12th (11th) interneural space; anal fin I,9–**11**–12 (I,11), its origin ventral or anterior to third soft ray of second dorsal; AP 2–**3**–4 (3); pectoral fin rounded, not extending to posterior margin of first dorsal fin, in life with several small, white spots near base, pectoral-fin rays 20–**21**–22 (21); segmented caudal-fin rays 9+8, branched caudal-fin rays **7**–8+**6**–7 (7+6); vertebrae **15**–16+**18**–19 (15+18).

Color in alcohol. Head and body light brown, becoming yellowish-white on ventral surface; tiny dark-brown or black spots covering most of head and dorsum forming several broad, irregular, dorsoventrally oriented bands on body and dark, y-shaped blotch near base of caudal fin; dark spots generally less dense, and often completely absent, on ventral surface of body and on pelvic fins; first dorsal fin with dark margin, unpigmented submarginal band, three indistinct transversely oriented dark bands, and large, dark blotch at posterior margin; second dorsal, caudal, and anal fins with small, dark spots and several indistinct bands, but without spots along margins; pectoral fin heavily spotted near base, more sparsely spotted elsewhere. Branchiostegal region, pelvic fins, and anal fin black in spawning females.

Etymology. The name *opperiens* is derived from the Latin verb *opperior*, meaning to wait or expect. This present participle therefore means "waiting", alluding to the fact that this species, although recognized as new for more than 20 years, has long awaited formal description.

Distribution. The specimens examined are from northeastern and central Honshu and southern Hokkaido in Japan, one locality on the island of Kunashir in the Kuril Islands, southern Sakhalin Island, and southern Primorski Krai in the Russian Far East. This species has been reported from Hokkaido to Ibaraki and Fukui Prefectures in Japan and the Korean Peninsula (Akihito *et al.* 1984).

Ecology. *Gymnogobius opperiens* is generally found hidden among rocks in shallow, fast-moving, rock-bottom streams and rivers. At least one population of this species, inhabiting a 1-km reach of an unnamed stream on the western side of Kunashir Island in the Kuril Islands, is notably tolerant of high water temperatures. Specimens have been collected in the vicinity of a thermal spring that empties directly into this stream, and individuals have been found in water temperatures in excess of 30°C.

Remarks. This species was first discovered by Nakanishi (1978a, b), who referred to it as the "middle reach type" of *Chaenogobius annularis*. Subsequent authors, including Akihito *et al.* (1984) and Pinchuk (1992) referred to it as "*Chaenogobius* sp. 1". Presumably these authors were reluctant to describe the species without a clear definition of *Chaenogobius annularis* for comparison. The distinctness of this species from *Gymnogobius urotaenia* and *G. petschiliensis* is further supported by the molecular evidence presented by Aizawa *et al.* (1994) and Suk *et al.* (1996).

Comparative remarks. *Gymnogobius opperiens* is very similar to *G. petschiliensis* and *G. urotaenia*. It can be distinguished from both species by the closely spaced posterior interorbital pores and dark, y-shaped blotch at the base of the caudal fin. Additionally, *G. opperiens* can be distinguished from *G. petschiliensis* by the presence of a dark blotch on the posterior margin of the first dorsal fin

and the presence of more than one sensory papilla in row *n*, and from *G. urotaenia* by vertebral count, dorsal-fin pterygiophore formula and, in life, the presence of white spots on the pectoral fin.

Gymnogobius urotaenia (Hilgendorf, 1879)
[Japanese name *ukigori*]
(Figs 4O, 8D)

Gobius urotaenia Hilgendorf, 1879: 107–108 (type locality: Japan).
Gobius laevis Steindachner, 1880: 138–140 (type locality: Japan). **N. syn.**
Chaenogobius castaneus: Jordan and Snyder 1900: 372. [Nec O'Shaughnessy, 1875]
Aboma urotaenia: Jordan and Snyder 1901b: 71.
Chaenogobius macrognathos: Jordan and Snyder 1901b: 76, fig. 13 (in part). [Nec Bleeker, 1860]
Chloea laevis: Jordan and Snyder 1901b: 80.
Chloea aino Shmidt, 1904: 207–208 (type locality: Lake Tunaichi, Sakhalin Island, Russia). **N. syn.**
Chaenogobius macrognathus: Jordan and Metz 1913: 56. [Nec Bleeker, 1860]
Gymnogobius macrognathus: Berg 1916: 424, fig. 313. [Nec Bleeker, 1860]
Chaenogobius annularis urotaenia: Tomiyama 1936: 91, fig. 38 (in part). **N. syn.**
Chaenogobius urotaenia: Takagi 1952: 14–22.
Chaenogobius annularis: Takagi 1966a: 17–27. [Nec Gill, 1859]
Gymnogobius urotaenia: Pietsch *et al.* 2001: 146.

Type material. *Chaenogobius urotaenia*: ZMB 10644, syntypes, 8 (24.3–31.4 mm), Japan, Hilgendorf. *Gobius laevis*: NMW 29508, holotype, 69.0 mm, Hakodate, Hokkaido, Japan, Steindachner. *Chloea aino*: ZISP 13106, syntypes, 3 (40.3–44.9 mm), Lake Tunaichi, Sakhalin Island, Russia, Brazhnikov; ZISP 13133, syntypes, 8 (59.7–110.3 mm), Arakul River, Sakhalin Island, Russia, Schmidt; NMW 82275, syntype? (possibly ex-ZISP 13133), 89.2 mm, Aniva Bay, Sakhalin Island, Russia.

Additional material. BMNH 1900.9.29.17–19, 3 (64.3–85.8 mm), Tokyo, Japan, Otaki; BMNH 1903.5.14.60–62, 3 (36.9–73.6 mm), Chikugo River, Japan, Jordan; BMNH 1907.12.23.268, 74.0 mm, Oki Island, Japan, Smith; HUMZ 40719, 40720, 40722, 40724, 40725, 40727, 40728, 7 (75.0–92.4 mm), Otaru, Hokkaido, Japan, Tsumura and Kahata; HUMZ 42111, 42117, 42132, 42135, 42136, 42144, 42157, 42165, 42166, 42167, 42173, 42174, 12 (46.3–72.5 mm), Shiodomari River, Hakodate, Hokkaido, Japan; HUMZ 69474, 57.1 mm, Oono River, Hokkaido, Japan; HUMZ 70091, 75.5 mm, Lake Biwa, Honshu, Japan; HUMZ 70112, 70116, 70122, 70126, 70128, 70131, 6 (87.7–108.9 mm), Onuma, Hokkaido, Japan; HUMZ 70172, 91.3 mm, Kunebetsu River, Hokkaido, Japan; HUMZ 70714, 86.7 mm, Moibe River, Aomori, Japan; HUMZ 132693, 78.0 mm, Hakodate, Hokkaido, Japan; HUMZ 133442, 49.8 mm, Hakodate, Hokkaido, Japan; HUMZ 135093, 51.8 mm, Hakodate, Hokkaido, Japan; NMW 30767, 87.5 mm, Jesso, Japan, Steindachner; NSMT-P 27289, 18 (40.4–74.6 mm), Japan; NSMT-P 59486, 77.0 mm, Ibaraki Prefectural Nature Museum; UW 027488, 44.0 mm, Shikotan Island, Kuril Islands, Pietsch; UW 027494, 8 (50.3–84.5 mm), Zelionyi Island, Kuril Islands, Pietsch; UW 028208, 4 (67.3–82.8 mm), Iturup Island, Kuril Islands, Pietsch; UW 029254, 5 (39.1–92.2 mm), Kunashir Island, Kuril Islands,

Pietsch; UW 029311, 93.2 mm, Shikotan Island, Kuril Islands, Pietsch; UW 044767, 10 (29.0–111.0 mm), Lake Barguzinskoye, southern Sakhalin Island, Russia, Stevenson, Woods, and Reimer; UW 044780, 8 (46.0–91.0 mm), Lake Dolgoye, southern Sakhalin Island, Russia, Stevenson, Woods, and Reimer; UW 044822, 2 (70.0–93.0 mm), Lyotoga River, southern Sakhalin Island, Russia, Stevenson, Woods, and Reimer; UW 044859, 2 (46.0–69.0 mm), Mereya River, southern Sakhalin Island, Russia, Stevenson, Woods, and Reimer; UW 044887, 4 (28.0–80.0 mm), Lake Lebyazhye, southern Sakhalin Island, Russia, Stevenson, Woods, and Reimer; ZISP 16837, 55.1 mm, Tumangan River, Primorski Krai, Russia, Chersky; ZISP 17454, 6 (45.9–55.9 mm), Tumangan River, Primorski Krai, Russia, Chersky; ZISP 49204, 48.7 mm, Kunashir Island, Kuril Islands, Kussakin; ZISP 49205, 103.5 mm, Iturup Island, Kuril Islands, Makushok; ZISP 49924, 8 (43.2–95.0 mm), Lake Tunaichi, Sakhalin Island, Russia, Nikoforov.

Diagnosis. Species of *Gymnogobius* unique in having anteriormost pterygiophore of first dorsal fin commonly inserted in fifth interneural space. Further characterized by following combination of characters: head broad and depressed, its width greater than its depth; anterior oculoscapular canals extending beyond postorbital region, opening through paired C, D, F, and G pores; right and left D pores distinct, separated by more than one-third orbital diameter; several sensory papillae in row *n*; lower jaw protruding anteriorly beyond upper jaw; maxilla extending posteriorly to or beyond posterior margin of eye; posterolateral end of mental flap indistinct; no fleshy, barbel-like processes behind chin; dark pigment patches forming series of broad bands on body; caudal fin dusky, with dark blotches forming distinct bands; 20–30 predorsal scales; 66–76 scales in longitudinal series; modal vertebral count 16+18; first dorsal fin usually with six spines; modal second dorsal-fin ray count I,11, anteriormost pterygiophore usually inserted in 12th interneural space; modal anal-fin ray count I,10, anal fin origin anterior to third soft ray of second dorsal fin; first dorsal fin predominantly dark with no bands or indistinct broad bands, and dark blotch on posterior margin.

Description. Body moderately elongate, its depth 15–22% of SL; caudal peduncle broad, its depth 9–12% of SL. Scales small, weakly ctenoid anteriorly, becoming clearly ctenoid posteriorly, covering entire body from base of pectoral fin to caudal fin, on dorsum extending anteriorly from first dorsal fin to posterior margin of opercle or beyond; head naked; scales in longitudinal series 66–76, scales in transverse series 19–22; predorsal scales 20–30. Several rows of sensory papillae in abdominal region; 29–32 vertical rows of sensory papillae in *lm* series.

Head broad and depressed, its width greater than its depth, with broad bulge on snout; eye diameter 17–22% of head length; interorbital space broad and flat, its width equal to or greater than orbital diameter; mouth large, directed slightly upward; lower jaw protruding slightly beyond upper jaw; maxilla extending posteriorly to or beyond posterior margin of orbit; small, conical premaxillary and dentary teeth in four irregular rows; posterolateral end of mental flap indistinct; no fleshy, barbel-like processes behind chin; gill rakers short, slender, without tooth patches, 1–3+6–8 (2+7). Anterior oculoscapular canals opening through paired C, D, F, and G pores (Fig. 4M); right and left D pores well separated; four suborbital rows of sensory papillae oriented longitudinally; two to six sensory papillae in row *n*, directly dorsomedial to F pore.

Dorsal fins approximately equal in height and separated, not connected by

membrane; first dorsal fin V–VII (VI); DF extremely variable, modally 5-2211000; second dorsal fin I,9–12 (I,11), anteriormost pterygiophore inserted in 11th–13th (12th) interneural space; anal fin I,9–11 (I,10), its origin ventral or anterior to third soft ray of second dorsal; AP 2–4 (3); pectoral fin rounded, not extending to posterior margin of first dorsal fin, pectoral fin rays 19–22 (20); segmented caudal-fin rays 9–10+8 (9+8), branched caudal-fin rays 6–8+5–8 (7+6); vertebrae 15–17+16–19 (16+18).

Color in alcohol. Head and body brown, becoming yellowish-white on ventral surface; tiny dark-brown or black spots covering most of dorsum, forming series of broad, vertical bands on sides and distinct dark blotch at base of caudal fin; dark spots generally less dense, and often completely absent, on ventral surface of body and on pelvic fins; first dorsal fin with dark margin, unpigmented submarginal band, dark blotch on posterior margin, and usually indistinct transversely oriented dark bands; second dorsal, caudal, and anal fins with small dark spots and several indistinct bands, but without spots along margins; pectoral fin heavily spotted near base, more sparsely spotted elsewhere. Branchiostegal region, pelvic fins, and anal fin black in spawning females.

Distribution. Specimens examined are from northern and central Honshu and southern Hokkaido in Japan; the islands of Shikotan, Zelionyi, Kunashir, and Iturup in the Kuril Islands; southern Sakhalin Island; and southern Primorski Krai in the Russian Far East. This species has been reported from Hokkaido to Kyushu (except Shikoku) in Japan (Akihito *et al.* 1984), Khabarovsk Province in Russia (Pinchuk 1978), and the entire Korean Peninsula and Quelpart (i.e. Cheju) Island (Mori 1928; Chyung 1954, 1977; Kim *et al.* 1987; Choi *et al.* 1990). *Gymnogobius urotaenia* is found in freshwater, preferring the slow-moving waters of rivers and lakes.

Remarks. This species was considered a synonym of *Gymnogobius macrognathos* or *Chaenogobius annularis* by many early authors. Tomiyama (1936) clearly distinguished it from *G. macrognathos*, but the lack of a satisfactory definition of *C. annularis* contributed to the continued confusion between these two species. Takagi (1966a) believed the type specimen of *C. annularis* to be lost, and on the basis of the original description he suggested that *G. urotaenia* may be a synonym of *C. annularis*; however, this suggestion was not universally accepted and both names continued to be used for this species. Stevenson (2000) resolved this problem by clarifying the identity of *C. annularis*.

Another potential issue with this species is the status of the name *Gobius laevis* Steindachner. The species recognized herein as *Gymnogobius castaneus*, which is characterized by a lack of oculoscapular canals and pores, has been recognized widely by previous authors as *G. laevis*. However, the holotype of *Gobius laevis* has well-developed oculoscapular canals with four pairs of pores. It also has a large mouth, with the maxilla extending posteriorly beyond the posterior margin of the eye, a broad and depressed head with widely separated posterior interorbital pores, and a conspicuous dark blotch on the posterior margin of the first dorsal fin. Therefore, *Gobius laevis* Steindachner is the same as *Gobius urotaenia* Hilgendorf. The question is which name was published first. Hilgendorf presented the description of *Gobius urotaenia* on a Tuesday at the 15 July 1879 session of the Gesellschaft Naturforschender Freunde zu Berlin. The description was published in the minutes of that meeting (*Sitzungsberichte der Gesellschaft Naturforschender Freunde*

Table 6. Measurements (mm) of type specimens of *Gymnogobius opperiens* n. sp. Snout length, postorbital head length, interorbital width, orbital diameter, interdorsal fin space, and upper jaw length are expressed in percent of head length; distance between D pores is expressed in percent of orbital diameter; all other measurements are expressed in percent of standard length. 1D=first dorsal fin, 2D=second dorsal fin, P1=pectoral fin, P2=pelvic fin, A=anal fin.

	Holotype	Range	Mean
Standard length	67.0	42.4–81.5	58.4
Body depth	18.4	11.9–18.5	16.3
Caudal peduncle depth	11.2	9.4–11.5	10.4
Caudal peduncle length	22.1	18.7–23.7	21.3
Predorsal length	36.6	36.5–42.7	40.3
Head length	28.7	28.7–33.8	31.3
1D origin to 2D origin	20.4	18.3–22.6	20.6
2D origin to A origin	17.3	13.7–17.6	16.2
P2 origin to A origin	32.8	31.8–37.1	34.1
Snout to P2 origin	31.5	28.6–36.4	31.3
1D origin to P2 origin	19.3	17.0–22.7	19.9
1D origin to A origin	31.2	26.7–31.2	28.9
P2 origin to 2D origin	34.3	31.4–36.3	34.1
Length of 1D base	17.2	13.3–17.6	15.8
Length of 2D base	21.2	17.0–21.1	18.9
Length of A base	16.3	13.8–18.5	15.5
P2 length	14.9	13.1–18.6	15.6
P1 length	18.7	15.2–21.9	19.9
Caudal fin length	20.0	14.6–23.8	21.2
Snout length	31.3	24.5–34.9	28.9
Postorbital head length	52.6	47.5–56.3	52.6
Interorbital width	16.1	9.5–19.3	14.1
Orbital diameter	17.7	14.9–20.9	17.4
Interdorsal fin space	13.5	7.0–18.7	13.9
Upper jaw length	39.6	37.3–59.2	46.6
Distance between D pores	27.6	16.5–40.7	24.5

zu Berlin) which, according to the title page of the volume, appeared sometime later in 1879. Steindachner presented the description of *Gobius laevis* on Thursday of the same week at the 17 July 1879 session of the Kaiserlichen Akademie der Wissenschaften, and that description was published in Volume 80 of the *Sitzungsberichte der Mathematisch-Naturwissenschaftlichen Classe der kaiserlichen Akademie der Wissenschaften*, which appeared in early 1880. That description also appeared in an earlier separate (presumably in late 1879), but the precise publication date of the separate cannot be established (E. Mikschi, pers. comm., 20 October 2000). Lacking clear evidence that the description of *Gobius laevis* was published before that of *Gobius urotaenia*, and in the interests of nomenclatural stability, *Gobius urotaenia* is herein considered the senior synonym. For the purposes of this nomenclatural act, the present author is acting as First Reviser as defined in Article 24.2.1 of the Fourth Edition of the International Code of Zoological Nomenclature (International Commission on Zoological Nomenclature 1999).

Comparative remarks. *Gymnogobius urotaenia* is very similar to *G.*

petschiliensis and *G. opperiens*, but is the only species in this genus with the anteriormost pterygiophore of the first dorsal fin commonly inserted in the fifth interneural space. It can further be distinguished from *G. petschiliensis* by the presence of more than one sensory papilla in row *n* and a dark blotch on the posterior margin of the first dorsal fin, and from *G. opperiens* by the widely spaced posterior interorbital pores and wedge-shaped dark blotch at the base of the caudal fin.

Nomen Dubium

Gobius (Chaenogobius) nigrimembranis Wu and Wang, 1931

Gobius (*Chaenogobius*) *nigrimembranis* Wu and Wang, 1931: 4–6, fig. 3 (type locality: Chefoo, China).
Chaenogobius nigripinnis: Wang and Wang 1935: 184 (error, see Remarks).
Chaenogobius nigrimembranis: Fowler 1961: 70–71.
Gymnogobius nigrimembranis: Lindberg and Krasyukova 1975: 379, fig. 294.

Remarks. The two syntypes of this nominal species were collected at Chefoo on the Yellow Sea coast and deposited in the Museum of the Biological Laboratory of the Science Society of China. Their whereabouts are currently unknown (see Remarks under *G. heptacanthus*). This species appears to have the second dorsal-fin ray and pectoral-fin ray counts of *G. mororanus*, and longitudinal series scale count and eye size between *G. mororanus* and *G. heptacanthus*. The first dorsal-fin ray count does not match either species, but all other characteristics seem to fit both *G. mororanus* and *G. heptacanthus*. This species is most likely a synonym of *G. mororanus*, but it is impossible to be sure without examination of the type series.

Wang and Wang (1935) incorrectly listed this species as "*Chaenogobius nigripinnis* (Wu and Wang)", referring to the species Wu and Wang (1931) had described in an earlier paper. This was an error, as they were certainly referring to the species described as *Gobius nigrimembranis* Wu and Wang, 1931. Wang and Wang (1935) described *Chloea nigripinnis* (=*Gymnogobius heptacanthus*) later in the same paper.

Nominal Species Assigned to Other Genera

Parawaous megacephalus (Fowler, 1905)

Chaenogobius megacephalus Fowler, 1905: 516–517, fig. 15 (type locality: Borneo).
Awaous megacephalus: Koumans 1940: 134.
Parawaous megacephalus: Watson 1993: 181–183, figs. 1–3.

Type material. *Chaenogobius megacephalus*: ANSP 114891, holotype, 71.7 mm, Borneo, W. H. Furness.

Remarks. The genus *Parawaous* can be distinguished externally from *Chaenogobius* and *Gymnogobius* by the presence of posterior oculoscapular and preopercular canals. *Parawaous* also has the anteriormost pterygiophore of the first dorsal fin inserted in the third interneural space and only 26 vertebrae (Wat-

son 1993).

Bryaninops erythrops (Jordan and Seale, 1906)

Chaenogobius erythrops Jordan and Seale, 1906: 404, Pl. XXXVII, fig. 3 (type locality: Pago Pago, Samoa).
Bryaninops erythrops: Larson 1985: 74–77, fig. 9.

Type material. *Chaenogobius erythrops*: USNM 51781, holotype, 11.8 mm, Pago Pago, American Samoa, Jordan and Kellogg.

Remarks. The genus *Bryaninops* can be distinguished externally from *Chaenogobius* and *Gymnogobius* by the presence of canine teeth and a pocket in the pelvic frenum. *Bryaninops* also has only 26 vertebrae and one epural (Larson 1985).

Acknowledgments

I thank H.-J. Paepke (ZMB), G. Duhamel (MNHN), S. L. Jewett (USNM), M. J. P. van Oijen (RMNH), J. A. Seigel and C. Thacker (LACM), D. Catania (CAS), W. G. Saul (ANSP), Y. Ikeda (BLIH), K. Amaoka and M. Yabe (HUMZ), K. Matsuura and G. Shinohara (NSMT), K. Sakamoto (ZUMT), M. Hatooka (OMNH), P. Campbell (BMNH), E. Mikschi (NMW), S. O. Kullander (NRM), A. V. Neyelov (ZISP), and S. V. Shedko for making material available. I also thank P. McGiffert (UW Health Sciences), Y. Ikeda (BLIH), T. Suzuki (Amagasakikita Senior High School), and M. Hatooka (OMNH) for specimen photography, and T. W. Pietsch for reviewing the manuscript. The work described here was supported by the Biological Sciences Directorate (Biotic Surveys and Inventories Program) and the International Program Division of the U.S. National Science Foundation, grant numbers DEB-9400821 and DEB-9505031, T. W. Pietsch, principal investigator; the Japan Society for the Promotion of Science, grant number BSAR-401, K. Amaoka, principal investigator; the Russian Academy of Sciences, V. Bogatov; and the UW School of Aquatic and Fishery Sciences Dorothy T. Gilbert Ichthyology Research Fund.

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